UNIVERSAL MODEL AIRPLANE NEWS

FEBRUARY 15¢

1933

"A COURSE IN AVIATION FOR FIFTEEN CENTS A MONTH!"

THE MONOCOUPE "COMING IN"

Plans, Page 10

MANEUVER CONTEST, Page 30

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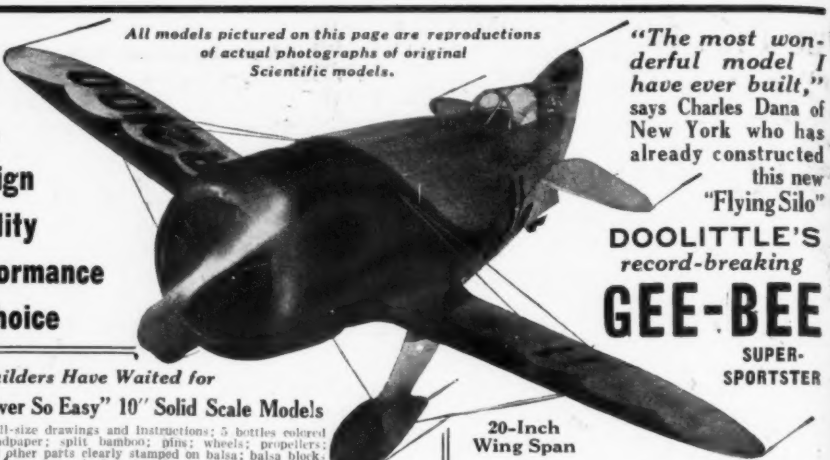
and are Every Boy's choice

All models pictured on this page are reproductions of actual photographs of original Scientific models.



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3/16 x 3/16	2½c	5 for 10c
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2½" diam. 25c
3" diam. 27c
3½" diam. 35c

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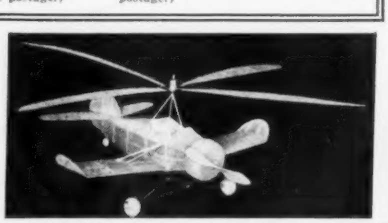

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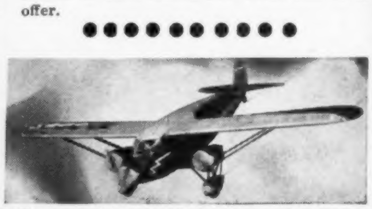

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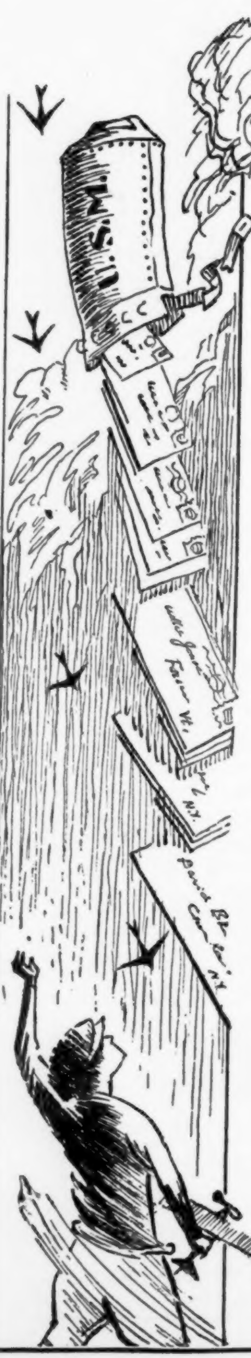

Edited by Charles Hampson Grant

CONTENTS

FEBRUARY—1933

In Our Next Issue

Our old friend, Orville Kneen, tells you Captain Jack Swaab's own vivid story of his experiences in the air during the World War, in the first installment of a series of three articles entitled "Fighting Wings."

Professor Alexander Klemin makes it interesting for prospective designers by telling about the many important considerations one must take into account when designing a transport plane, in Reflections of an Airplane Designer.

You will be pleased with the plans and instructions to build the extremely fine model of the French Morane Saulnier monoplane as given in Building the Morane Saulnier "Pursuit," by Richard Rioux.

Order your copy of UNIVERSAL MODEL AIRPLANE NEWS from your newsdealer now, or send $1.65 for your year's subscription to this office, 125 West 45th Street, New York City.

Mr. Howard McEntee gives us some more useful hints on model building in another installment of "Whats" and "What Nots" of Model Plane Building.

Detail 3-View drawings of the Bristol Bull Dog and several other three views of modern and wartime models by Stockton Ferris, Jr., as well as other regular features, make the March issue extremely interesting.

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A typical Training Airplane which embodies features explained in this article

Reflections of an Airplane Designer

Important Facts the Engineer Must Consider When Designing a Training Plane

By Alexander Klemin
Prof. of Aeronautical Engineering, N. Y. Univ.

(EDITOR'S NOTE: This is the first of a series of articles by a well-known aeronautical engineer, whose scientific attainments are coupled with many years of experience in building a number of successful and varied types of planes. This first article will deal with the general process of designing an airplane, with special reference to the training plane, which is also likely to be useful to the private owner. The second article will take up the problems of the transport plane. In the third article, Professor Klemin will deal with the possibilities of the huge flying boat in transatlantic service.)

IT is very easy to design an airplane that will fly. With all the vast experience that has been gathered in this art, with all the books, magazines, government publications and other sources of information available, the problem looks to be quite a simple one. And it is easy to design a machine that will fly. But it is extremely difficult to design one that will be satisfactory from every point of view, or that can be sold.

The reason is that there are more things to think of in designing an airplane than in devising almost any other mechanism known to man.

If one of our readers were stranded on a desert island, he would have little difficulty in improvising a rough bridge. The hero of a story, though but a draftsman, might grasp the opportunity of a lifetime and design a bridge across the Hudson with the help of a handbook or so. But an airplane involves all the structural problems of a bridge, together with all the power plant complications of a motor car—in fact, the difficulty of a bridge that can be propelled by an internal combustion engine and on occasion turn somersaults in the air!

The Specification

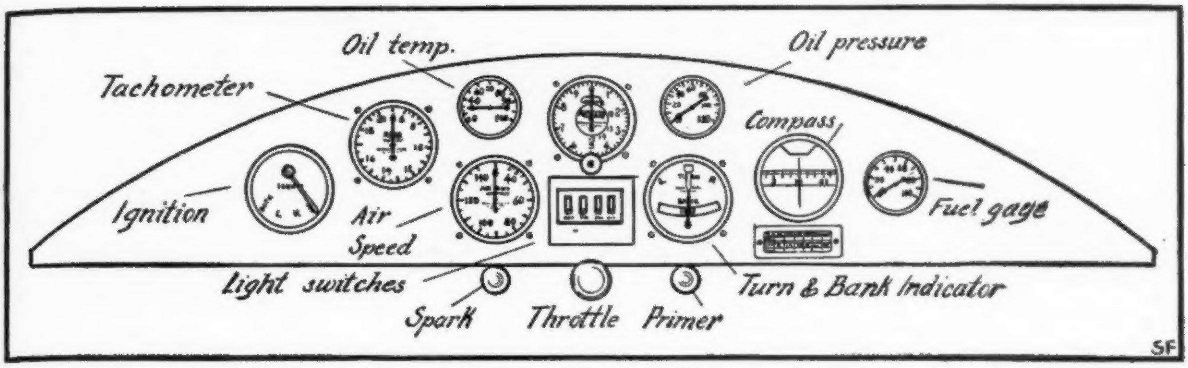
The difficulties met in designing begin with the writing of the specification, which is a brief statement of all that the engineer plans or hopes to achieve.

Let us consider the specification of one of the fundamental types in aviation: the two-seater training plane, which should at the same time serve the purposes of the private owner or of the private flier.

Engines cost money to buy initially and are expensive in fuel and oil, subsequently. So the moderately priced two-seater training plane should be equipped with an engine of not more than 90 to 100 horsepower. In aviation, engines of immense power are employed. For example, in the Schneider Cup racers the "souped-up" Rolls Royce engines developed more than 2,000 horsepower. Therefore, 90 horsepower does not look so very powerful to the plane designer. Yet 90 horsepower is more power than is employed on the majority of the motor cars of today.

While we are limited to some 90 horsepower and while, in training, high speed is not the prime essential, it is no good telling the prospective purchaser that we can give him a slow, perfectly safe craft. Unless speed goes with it, the airplane is useless. So, after much discussion, the top speed is fixed at 110 miles per hour.

Concessions to safety there

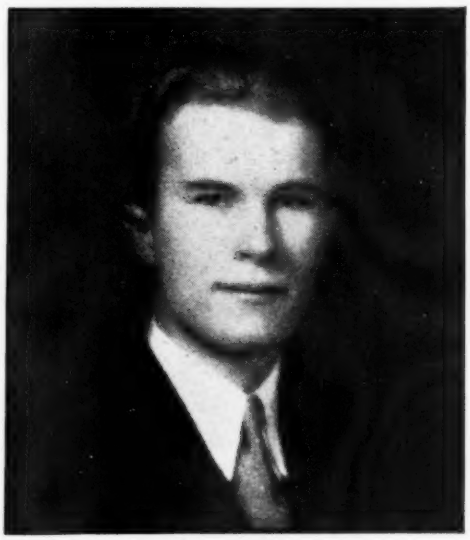


must be, however. The faster an airplane lands, the greater the danger of making a bad landing. The faster an airplane lands, also, the longer the subsequent roll on the ground. Therefore, the stalling speed or minimum speed in the air must be fixed at a reasonably low figure, say 45 miles per hour. This is in reality far too high. But if we make the airplane still slower in landing, the top speed will suffer. The designer is on the horns of a dilemma and his final decision is a compromise.

Not all flying fields are of huge dimensions. Our private owner may have to make use of small fields surrounded with obstacles in the form of trees, or telegraph wires. Therefore, our craft must be able to climb speedily and steeply. We fix on an initial climb from the ground 600 feet per minute, or 10 feet per second, which is quite as fast, if not faster, than an elevator in an office building.

Next the designer must decide what useful load his plane will have to carry. The occupants are two in number, pilot and student. Two hundred pounds must be allowed for each. This is *not* because all the occupants will be football players or heavyweight wrestlers, but simply because when flying clothes, parachute, etc., are allowed for, two hundred pounds is not an exaggerated allowance. In training, no great supply of fuel and oil is required, since flights are always short in duration. To learn to fly moderately well is not difficult, but half an hour's real application in the air is as much as any student can stand at any one time.

Our plane, however, is not going to be used for training alone. It is going to be sold to the sportsman pilot, who may wish to make cross-country flights. Therefore, we must have fuel for at least three hours' flying at full throttle or power. The engine, at full throttle, will consume perhaps 9 gallons an hour, and we fix on the liberal allowance of 30 gallons of gasoline. Ordinary aviation gasoline weighs 6 pounds a gallon, and that makes 180 pounds. The oil should be at least 2 gallons, and oil weighs 8 pounds a gallon, so that makes another 16 pounds. Add 30 pounds of baggage, and the useful load is:



Paul C. Spiess, designer of the prize winning plane

Two occupants	400 pounds
30 gallons of gas	180 pounds
2 gallons of oil	16 pounds
Baggage	30 pounds

making a total "useful load" of 626 pounds.

NEXT we must take up the question of instruments. Once upon a time fliers preferred to fly by feel and despised instruments. Wetting a finger to tell the direction of the wind was not an uncommon practice. But now things have changed and resort is had more and more to instruments. We even have blind flying, in which a plane in a fog is piloted solely by instruments. It is true that our plane is not going to be used primarily for blind flying, but it may be used in cross-country work. Therefore, let us have a sufficiency of equipment. After heated arguments we decide on the following list:

An altimeter: which will tell the pilot how high he is flying and indirectly how fast he is climbing.

An air speed indicator: which will tell him how fast he is flying relatively to the air. (It will not tell him how fast he is flying relatively to the ground unless he happens to know the speed of the wind.) The air speed indicator also serves to warn the flier of the dreaded "stall" when its reading becomes too low for safety.

Inclinometers (or levels): one level placed fore and aft to show whether the plane is nosing down or up too much; another level placed athwartship to help in keeping the craft on an even keel laterally.

Compass: whose utility is obvious.

The engine instruments: comprising a *tachometer,* which indicates the revolutions per minute of the engine; the *oil thermometer,* which shows whether the oil is at a proper temperature and the lubrication what it should be; the *oil pressure gauge,* which shows whether the oil is being properly circulated to all the vital points of the engine; and a *gasoline gauge,* to show whether the fuel supply is still adequate. It is obviously much more uncomfortable to run out of gas in the air than in a motor car.

To a customer well provided with cash we can perhaps sell a few extra instruments, such as the Sperry artificial horizon, and a turn indicator—indispensable to real instrument flying. A typical instrument board is shown above.

As far as other equipment goes, the base price will only cover a hand fire extinguisher, independent wheel brakes, a starter and navigation lights. Again, if the customer is feeling good, we can always charge a little extra for a convertible top (turning the open cockpit into a comfortable cabin) or some night flying equipment.

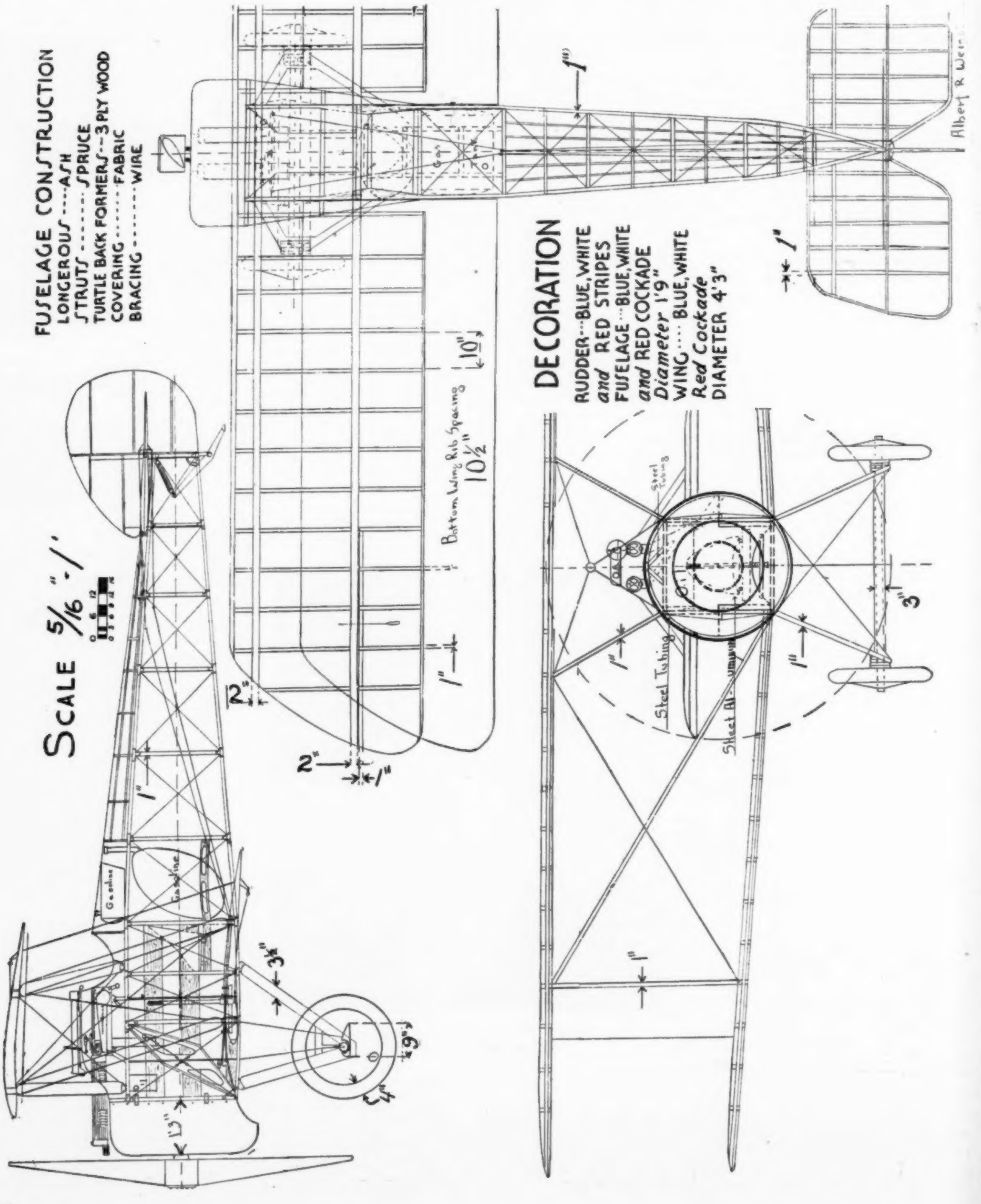
Besides these specific items, (*Continued on page* 36)

The Wartime Sopwith Camel

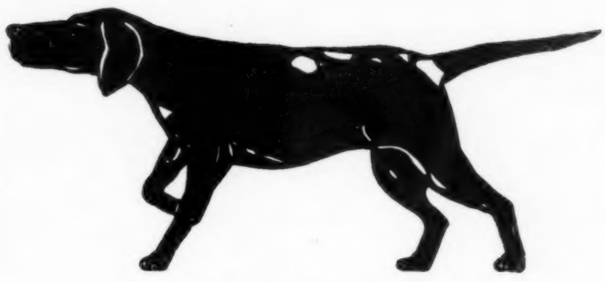
THIS little single-seater fighter was one of the most effective fighting ships of the World War, combining the qualities of high performance with great maneuverability. It was especially active during 1917.

Powered with a Clerget 130 h.p. engine it developed a speed of 133 m.p.h., at 10,000 feet. In five minutes it could climb to five thousand feet. The total weight of the machine loaded was 1,524 pounds.

The Camel was manufactured by the Sopwith Aviation Company, Ltd., at Canbury Park Road, Kingston-on-Thames. Mr. T. O. M. Sopwith, the well-known aviator, established the company at Brooklands in 1911, where during 1912, two biplanes were put on the market; one of 70 h.p., and another of 40 h.p. One of the other noteworthy products of the Sopwith Company was the Sopwith Triplane, used at the Front in 1916.



Insignia of Naval Air Station, Pensacola, Fla.



Insignia of Scouting Squadron, No. 2.

Insignia of Patrol Squadron, No. 9.

Fighting Trademarks of the Air

The Story of the Vital Part That Marks of Identification Play in the Drama of Air Combat

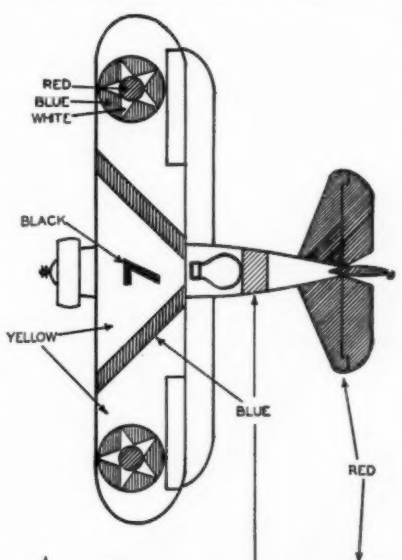
By Lieut. (j.g.) H. B. Miller

IT was a cold winter day in the North of France. The fresh snow on the ground aggravated the raw bitterness of the season to those in the trenches, huddled around small fires in an effort to keep warm. High above in a little single-seater crouched a half-frozen pilot. Not only was he cold, he was lonesome. Inexperienced and with but a few flights over the front lines, he had become separated from his patrol and now was practically lost. Pride alone prevented him from turning back to his airdrome. If he didn't relocate his squadron and join up with them he would be the victim of much sport over that night's dinner table.

In the distance he saw a flight of small planes—probably his own for they were on his side of the lines. It was really too cold to get one's head out from behind the cowling in order to look around for details. Opening his throttle wide he started a long, fast glide to the group of aircraft far below. He had not yet learned that extreme caution was necessary if one were to return safely from patrols day after day. There, he thought, lay companionship, safety. Besides, the idea of joining up with his own outfit after being separated appealed to a certain amount of immature pride.

Laughing at himself for his temporary fright of a few minutes earlier, the young flier had nearly caught up with the planes when they suddenly separated and swung around towards him in soaring Immelmann turns. The machines had a strangely unfamiliar appearance and the youngster suddenly realized that he had been on the trail of a flight of German aircraft. Wheeling about he scarcely made good his escape, his spare altitude alone making possible his getaway.

The proper identification of aircraft may be a life or death matter to the military or naval pilot. It would be nothing short of suicide for a pilot to join up in formation with a group of enemy machines. Unless he knew which planes to attack he might reasonably permit an enemy formation to approach too closely to a group of planes which he was protecting, with the result that his function as a protective escort would be completely nullified.



AS the World War went on, the need for the quick identification of aircraft became more imperative. Every aviator spent much time on the ground carefully studying the silhouettes of the various types of enemy aircraft. These figures were constructed to portray the machines from all angles and in all maneuvers. Only by means of such study could the new pilot at the front see a plane thousands of feet below him and feel justified in going down after him with wide-open throttle and machine-gun stripped for action. Then, too, the squadron leader, observing at a glance when his flight was being outnumbered by the enemy, could lead his own aircraft to a place of safety.

To the casual observer an airplane is merely a machine that flies. To his untrained eyes there is nothing to distinguish one from the other, for all have wings, tails, and engines. On the other hand, the experienced pilot looks over all airplanes very closely and at a glance takes in and stores in his memory the multitudinous features which serve to make that particular aircraft different from all others. The wing arrangement may be unusual, the fuselage may have a peculiar shape, or the engine mounting may be unique. As an example, a certain make of naval aircraft can be identified as far as the eye can see by nothing more than the peculiar shape of the rudder and its accompanying vertical stabilizer.

In spite of silhouette study by inexperienced pilots during the war, many potential

Sketches by Eddie Collins


Insignia of U.F.-6 Fighting Plane Squadron, No. 6.


Insignia of U.F.-1 Fighting Plane Squadron, No. 1.


Insignia of U.S.-1 Scouting Plane Squadron, No. 1.

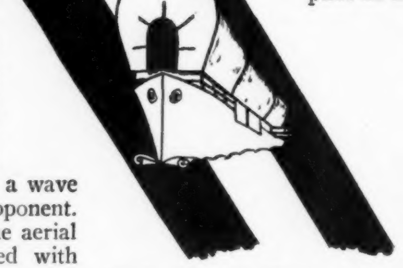
encounters were prevented because of lack of proper identification. It was also true on a few occasions during periods of low visibility that aviators were shot down by their fellow-pilots. It became imperative that planes have definite markings or insignias. It was then that the aviation forces of both sides went back to the Middle Ages for the solution to their problem. As each warrior in feudal days had worn a device upon his shield to identify himself, so the Central Powers placed the Maltese Cross as an emblem of nationality upon each one of their planes. Likewise, the tri-colored cocardes were immediately painted on all of the Allied aircraft. By varying the color of the three concentric circles, the Allies were enabled to provide a distinguishing mark for each nation.


Insignia of U.T.-2 Torpedo Plane Squadron, No. 2.

THE carrying of a national insignia was not the only similarity between the pilots of the early days of aerial warfare and the gallant knights of old.

The condition at the first few months of the war, when scouting pilots of opposing forces waved to each other in greeting, could hardly be expected to continue for long. It is recorded that the first pilot to make a belligerent move dropped a rock overboard in the hopes of hitting a hostile aircraft. The climax of this was the appearance of pistols and finally rifles were considered legitimate weapons. Eventually, rapid-fire machine-guns proved to be much more effective.

However, there was a long period when a single plane would engage a lone aircraft quite like the Age of Chivalry, when knight met knight on the jousting field. Cases are not unknown where two evenly-matched pilots would break off a conflict with a wave to acknowledge the skill of the opponent. Challenges were also arranged and the aerial duel which resulted, invariably ended with the loss of one pilot or the other.

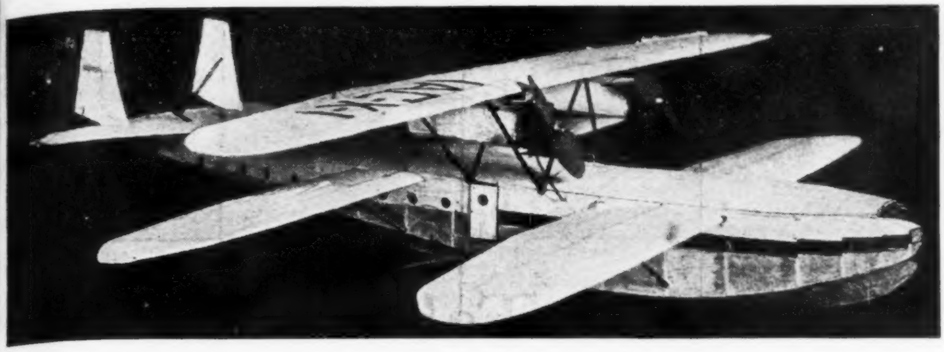

Insignia of Planes from U.S.S. Langley.

Just as the knights felt the need of an emblem signifying their allegiance, so did the airmen of the modern age. The knight carried his liege lord's crest in a prominent position on his shield, while the airman painted his national colors upon the top of his wings. Even though the medieval warrior had his face encased in armor, his shield served for his identification. Likewise, though aerial combats were started at a fairly long distance, the insignia stood out clearly to identify friend or enemy.

Another factor which began to enter into the matter of marking planes was the pride of each squadron concerning the prowess of its pilots. Much good-natured though intense rivalry was growing between aviation units. This led to the adoption of a squadron insignia which was painted boldly on each of the machines belonging to an organization. Thus developed the Cyogenes or Storks of the famous Guynemer and the equally renowned Hat-in-the-Ring squadron of Eddie Rickenbacker. Naturally, much publicity was given to the enemy concerning the skill of certain squadrons for it was hoped that their morale would weaken materially when it was discovered that a famed flying unit was confronting them above the front lines.

The Germans were apt to carry their individualistic schemes somewhat further and frequently each pilot painted his plane as his fancy dictated. No doubt, some of them were endeavoring to take advantage of the protection offered by camouflage. Others, however, felt that a certain grotesqueness would tend to startle and upset an Allied airman. For instance, von Richthofen flew a fiery red Fokker which was calculated to shatter the nerve of any enemy pilot he should chance to meet. Personal identification marks on the Allied planes were somewhat commonplace. On the side of the fuselage would be painted a square, triangle, circle, or other simple geometric figure.

SINCE the World War, better and more certain methods of identification have been devised. Squadron formation is maintained much more easily, an important point when we realize that the individual dogfights of the war are gone. Now, the patrolling group which can maintain its integrity will win its battles. Simple and quick means of identification will assist in this. Even if aircraft from a strange though friendly squadron should suddenly appear in the sky, they will be as (*Continued on page* 35)



A five-foot model of the Followplane that has made remarkable flights. It is powered with two compressed air engines and is perpectly stable.

The Plane of the Future?

Interesting Features of a New Development That May Revolutionize Airplane Design

By David D. Grant

IF some of you older model fiends will think real hard you may remember some years ago, when some of current mechanical magazines came out with articles, very short, on a flying boat that looked like an ocean liner with five sets of biplane wings parked along the hull in two staggered rows. That old crate looked like nothing more nor less than some fool inventor's brainstorm and nothing more was generally heard of it or thought of it.

But one of the world's best aeronautical engineers got hold of it and backed by a little-known but influential company, he completely made over the ship, retaining only the idea of the tandem wings. The result is really something to be proud of.

Instead of the crazy oversized ocean-liner hull that the inventor had, he gave the ship a Richardson hull, the same as is used on all the Dornier boats, and, for that matter, all successful large flying boats. Instead of the five sets of biplane wings, he gave it three monoplane wings, and instead of a whole flock of motors parked in any old place, he hung four powerful radial engines from the upper wing, in much the same manner as the motors of Uncle Tony Fokker's F-32 are hung. Then he put on a nice healthy empennage (tail, to you) and a pair of sponsons for balance in the water, and a new ship was born.

And what a ship! The first successful tandem airplane. Here are a few facts on it, such as are obtainable.

It is the first tandem airplane which has control in yaw. It is absolutely spin proof and stall proof. It is compact in size; for a given wingspread it will carry three times the load of a monoplane over a cruising radius nearly three times as great, at very little greater cost per flying mile than the monoplane. Therefore it cuts flying costs down to one-third of their present size, and since they are already down almost to railroad rates—well, use your own imagination. Furthermore, the plane is inherently stable. Its righting tendency is so great that it is impossible for the pilot or any stray wind current to get it into a dangerous attitude in flight.

It has the edge over every plane ever built for transport service in weight-carrying ability, performance, features such as lift, climb, speed, landing, cruising, and high ceiling, pay load / gross weight ratio, and economy of operation. By this I do not mean that it excels every ship in every feature; there are faster ships, and ships with lower landing speeds, but to obtain those features, those other ships had to make tremendous sacrifices to the other features, mainly carrying ability and economy.

I am not permitted to give here the detailed specifications and performance figures on this ship, so you will have to take my word for it on the general points that have already been stated. But I can tell you a little about the reasons we have for knowing what the ship will do, even though it has never been built. Hundreds of thousands of dollars have been spent on thousands of wind tunnel tests at the United States Bureau of Standards, Massachusetts Institute of Technology, and Professor Crookes' private tunnel. Every one of these tests, witnessed and checked by disinterested authorities, prove every claim of the designers, far beyond even the wildest hopes or dreams of the inventor or the engineer who designed it.

TWO flying models of this ship have been built, both in the summer of 1931. The first of these was a five-foot wingspread scale model, powered by two three-cylinder radial compressed air engines. This model, picture of which can be seen above, has made some remarkable flights. Although the air pressure was so reduced by the use of two motors that the model was unable to take off, it still showed very definitely the characteristics claimed for the ship. Its wing loading was three and one-quarter ounces per square foot of surface, and with such a light loading it will be readily seen that the slightest breath of air will affect its flight. No gust of air, from any direction, ever moved the model more than eight or nine degrees from an even keel in any direction, and the model invariably returned to an even keel within one second, with no loss of altitude. When one motor was accidentally disconnected, the model banked slightly and naturally and flew perfectly steadily in a broad circle until it landed. The model has never crashed.

The other model was a twenty-two-inch landplane model, powered by a single rubber band motor. This model was very low powered as models go, having barely enough power to climb steadily when fully wound, yet it would fairly leap into the air with less than six inches of ground run, from a standing start, tail down, and no external aid.

When slightly tail heavy the model would climb at a steep angle until it looked as though it would surely stall, then, as the power was not sufficient to hold it in its climb, it would seem to stop almost dead still in the air, make an eighty-degree turn to the right, drop the nose about eight or nine degrees and within ten feet it would be climbing again, having lost no more than one foot of altitude. This model never crashed either, but within a few months disintegrated from hard use and abuse.

(*Continued on page* 48)

Here is the finished Monocoupe model

Just like the big ship

The Monocoupe Takes the Air

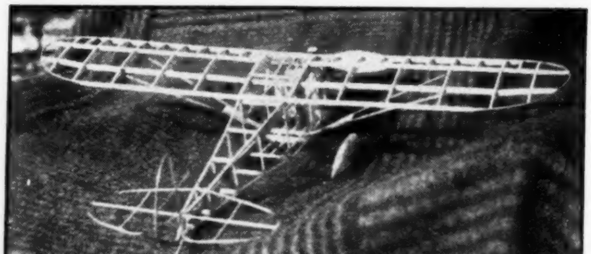
How You Can Build a Flying Scale Model of One of the Fastest and Most Popular Cabin Sport Planes

By Howard McEntee

THE Monocoupe is a trim little ship which is much used for sport flying. It is not a light plane by any means but it is small and economical, which accounts for its great popularity. When fitted with streamlining, as our model is, and a motor of around 125 h.p., the top speed is about 145 m.p.h., while the climb is 1200 feet per minute. The Monocoupe has won many races because of its fine performance and so is a favorite with sportsmen.

The wing span of the large ship is 32 feet, which we have reduced to about 21 inches. Many different engines have been used in the Monocoupe, including Lambert, Warner Scarab, and Kinner B5, which later we will reproduce.

The seating arrangement is side by side and two people can be accommodated.



Mr. McEntee, as usual, has carefully worked out the frame construction

LIST OF MATERIAL

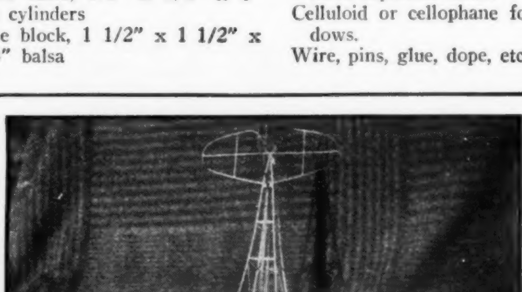
- 10 lengths 1/16" square balsa
- 2 lengths 1/8" square balsa
- 2 lengths 1/16" x 3/32" balsa
- 2 lengths 1/8" x 3/16" balsa
- 2 lengths 1/16" x 3/16" balsa
- 1 length 1/8" x 1/4" balsa
- 1 length 1/16" x 2" balsa
- All above strips 18" long
- 1 propeller blank, balsa
- 1 piece balsa, 1/2" x 1/2" x 6" for cylinders
- 1 nose block, 1 1/2" x 1 1/2" x 3/4" balsa
- 1 piece balsa 1" x 1/4" x 8" for pants
- 7 strips bamboo 12"x1/16"x1/4"
- 2 wheels 1 1/8" diameter and 3/16" thick
- 6 inches 1/16" O. D. aluminum tubing
- 1 prop hanger and 2 washers
- Six feet 1/8" flat rubber
- 1 sheet superfine tissue
- Celluloid or cellophane for windows.
- Wire, pins, glue, dope, etc.

Fuselage

The fuselage is not unusual in construction. The two sides are first built up on a board and then fastened together. The last side to be built up is not cut off the board but assembly is started right there. Since the fuselage is of uniform width under the center section, we can start assembly with all cross struts at this point. The bulkhead A is also of this width, so glue it to the side on the board first. Then glue on the two cross pieces, top and bottom, at the rear of the cabin. When the glue has set a bit, fasten the other fuselage side on top, holding it in place with weights. You now have the fuselage on its side, on the board. When this much is dry, cut it off with a razor blade and install the cross pieces at the rear of the cabin, two at a time, until all six are in place. You must note carefully the distinctive shape of the fuselage at the rear of the wing and take care that you have it correct, or your model will not look like a true Monocoupe.

The rudder post B of bamboo, the tail skid, also of bamboo, and the small bulkhead C of balsa are installed and complete the rear of the fuselage. The nose block D is of balsa and is slightly oval at the rear, the longest dimension being from top to bottom. It is easily cut out of balsa, starting from a disc of balsa $1\frac{1}{2}''$ x $\frac{5}{8}''$, and sanded to shape. Before installing, cut the hole for the motor stick. There are only two formers to make, E on top and F on the bottom of the fuselage. E has five slots for the stringers, these slots corresponding to those on the top of A, while F has three, spaced the same as those on the bottom of A. There are two other stringers, one on each side of the fuselage—from A to D.

The fuselage is completed by installing the motor stick clip on the rear of D, gluing it on well.

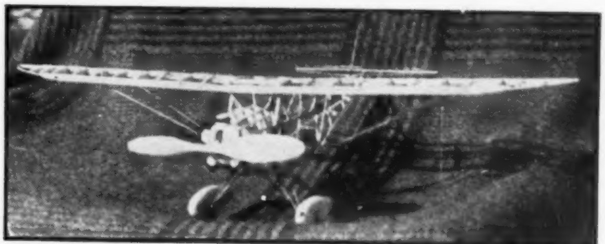


Frame weights are well forward

Center Section

While the real ship has no center section, we use one,

Showing unusually trim lines for a model



The frame is strong and well designed

mainly to make the wings easy to remove.

Cut two ribs from fairly hard 1/16" balsa, similar to curve No. 1. Two main spars are used, G and H. These have the wing pins glued and bound on each end before assembly. The center section is assembled directly over the drawing, with wax paper over the page. Accurate work must be done so the wings will be straight when the ship is finished.

The two 1/16" square pieces on top are for the window edges.

The completed center section is glued directly to the top strips, K, of the fuselage. Two 1/16" x 1/32" bamboo strips run down to former E to prevent sideward twisting.

Landing Gear

The struts of bamboo are glued in place first. They should be bound together at the lower ends. While they are drying, the wheelpants are made. These are each in three pieces, a center and two sides. First cut out all pieces to the same shape, two being ¼" thick, and four being 1/16" thick. Then cut out the wheel space on the ¼" pieces with a coping saw and glue the pieces together. It is best to put them in a vise, or at least under a weight, so they will not warp while drying. Allow an hour or more for drying or they will come apart while being finished off. The finishing is done mostly with sandpaper, with all edges being well rounded. The wheels are 1⅛" diameter and 3/16" thick. They will probably have to be home-made, as most commercial wheels are too thick. They may be made either by cutting discs from 3/16" flat balsa or by turning on a lathe or motor, the latter method naturally being best. They should have a bushing of brass or aluminum tubing through the center so they will run true and not scrape.

The axles are all in one piece, in the general shape of a Vee, the apex of which is glued to the rear of bulkhead A. This axle, together with the pants and wheels, are all assembled together before being fastened to the fuselage. Before assembling, the wheels should be painted, as should the inside of the pants. The holes for the axle should be carefully made so the wheels turn without rubbing. After the wheels and pants are on, the wires on the outer sides are bent to the rear. Glue is applied to this bent end and also to the wire on the other side of the shoe. This must be left to dry absolutely hard, when the shoes can be straightened and the whole assembly glued to A. The center fairing strip must be cut to get it in place. The wire goes to the *rear* of the landing gear struts. This is so that there can be plenty of motion to take up bumps on nose low landings. The wire is fastened to the struts with 1/32" square rubber or a small rubber band. Experiment until you get the proper spring without too much rearward motion.

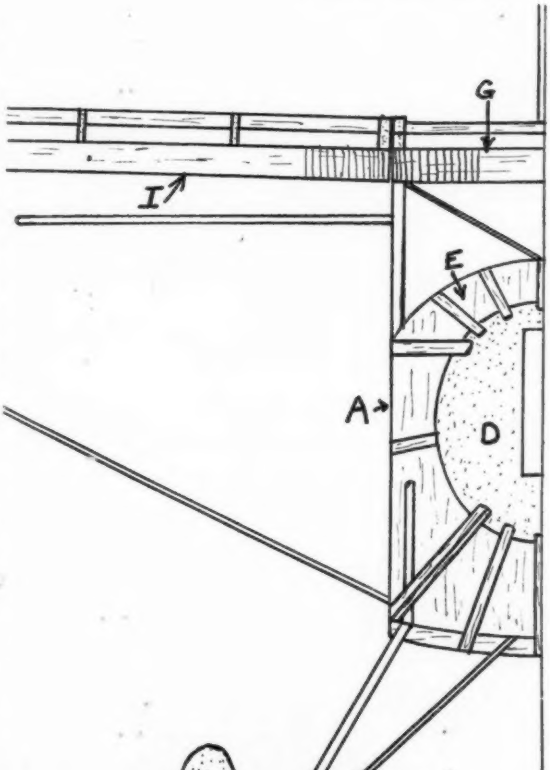


FIG 6 FULL SCALE

Tail Surfaces

THESE are made completely from split bamboo. The horizontal tail is made first and assembled directly over the drawing, using wax paper on the page. The outline is in two pieces. Bend one piece of double size over a flame and then split it to make the two pieces. Allow the work to dry thoroughly, then glue it in place on the tail. The rudder follows, its single rib being put in place last. A small triangular piece of balsa is glued between the rudder post and the lower end of the rudder for strength.

Motor Stick

The motor stick is made of fairly hard balsa, ⅛" x ¼" x 11 ½". It should be sanded off smooth and the propeller hanger and tail hook glued on.

The propeller is carved from a blank of the dimensions shown. It may be left quite thick so that it will have plenty of strength and also add some weight to the nose.

The rubber motor is of ⅛" flat rubber and may vary between three and six strands, depending upon the weight of the finished model. A medium-weight model will take about four strands.

The dummy motor may as well be made now. The five cylinders are of balsa, ⅜"

(*Continued on page* 45)

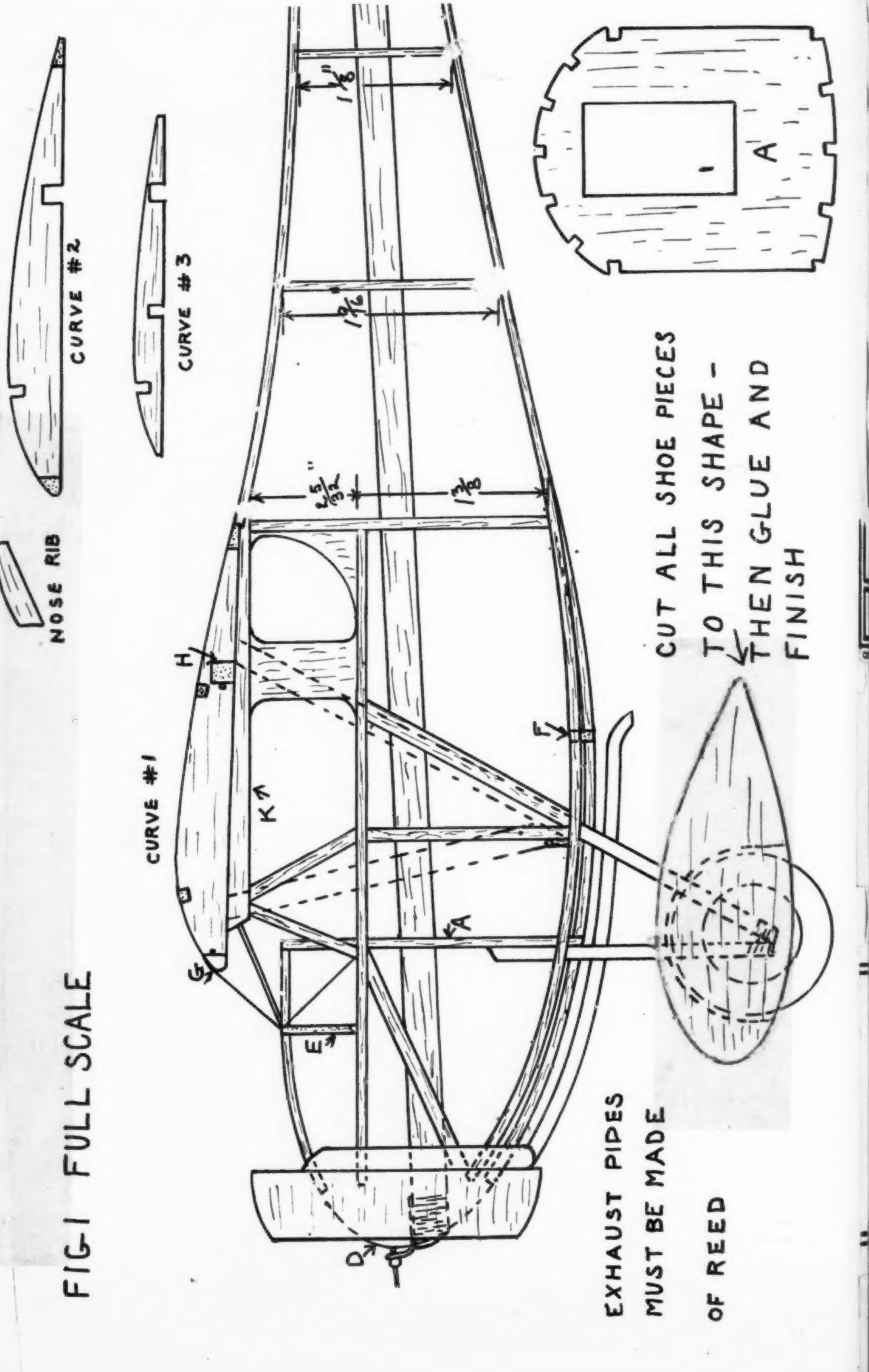


FIG I FULL SCALE

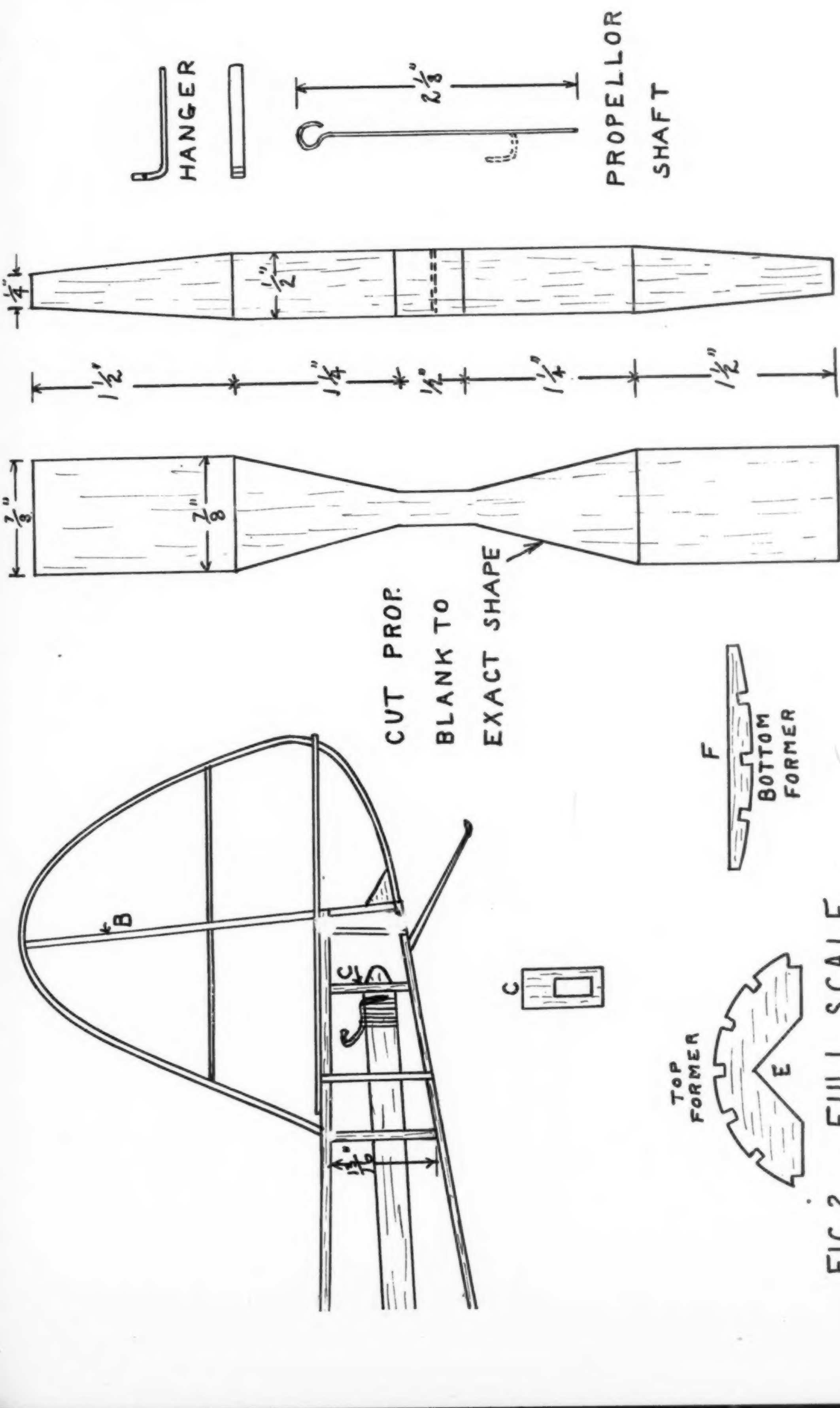


FIG. 2 FULL SCALE

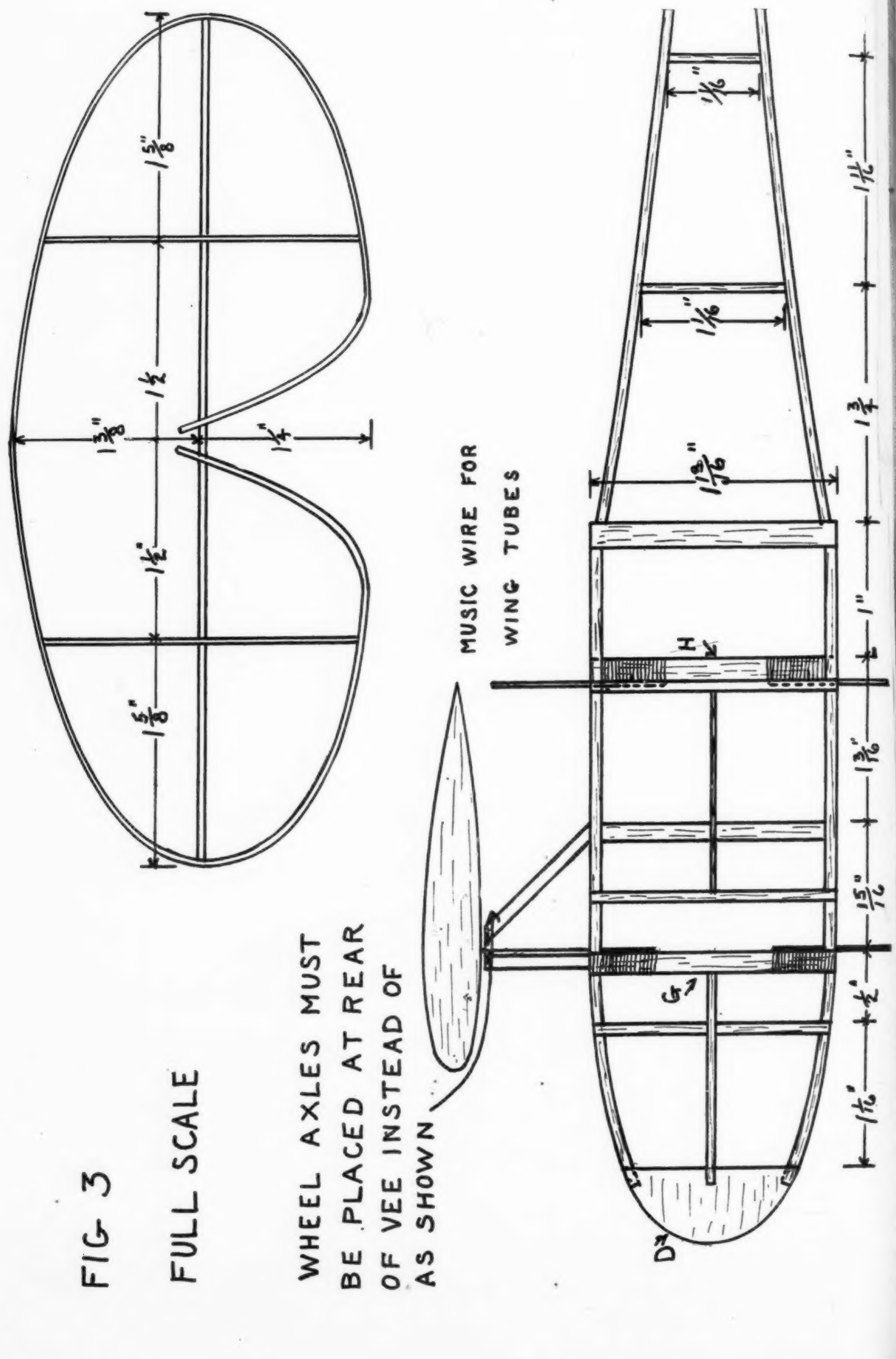


FIG 3

FULL SCALE

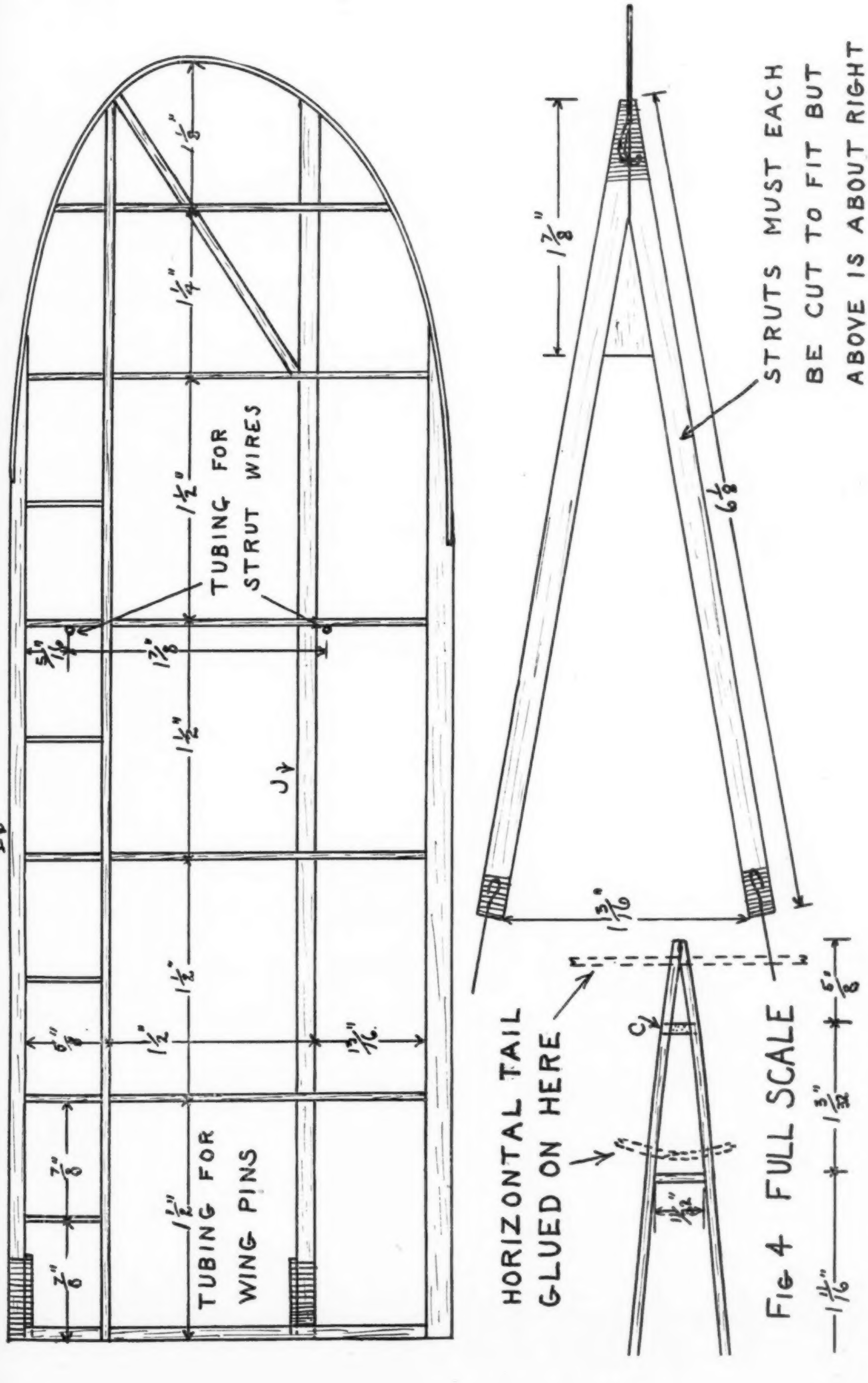


Fig 4 FULL SCALE

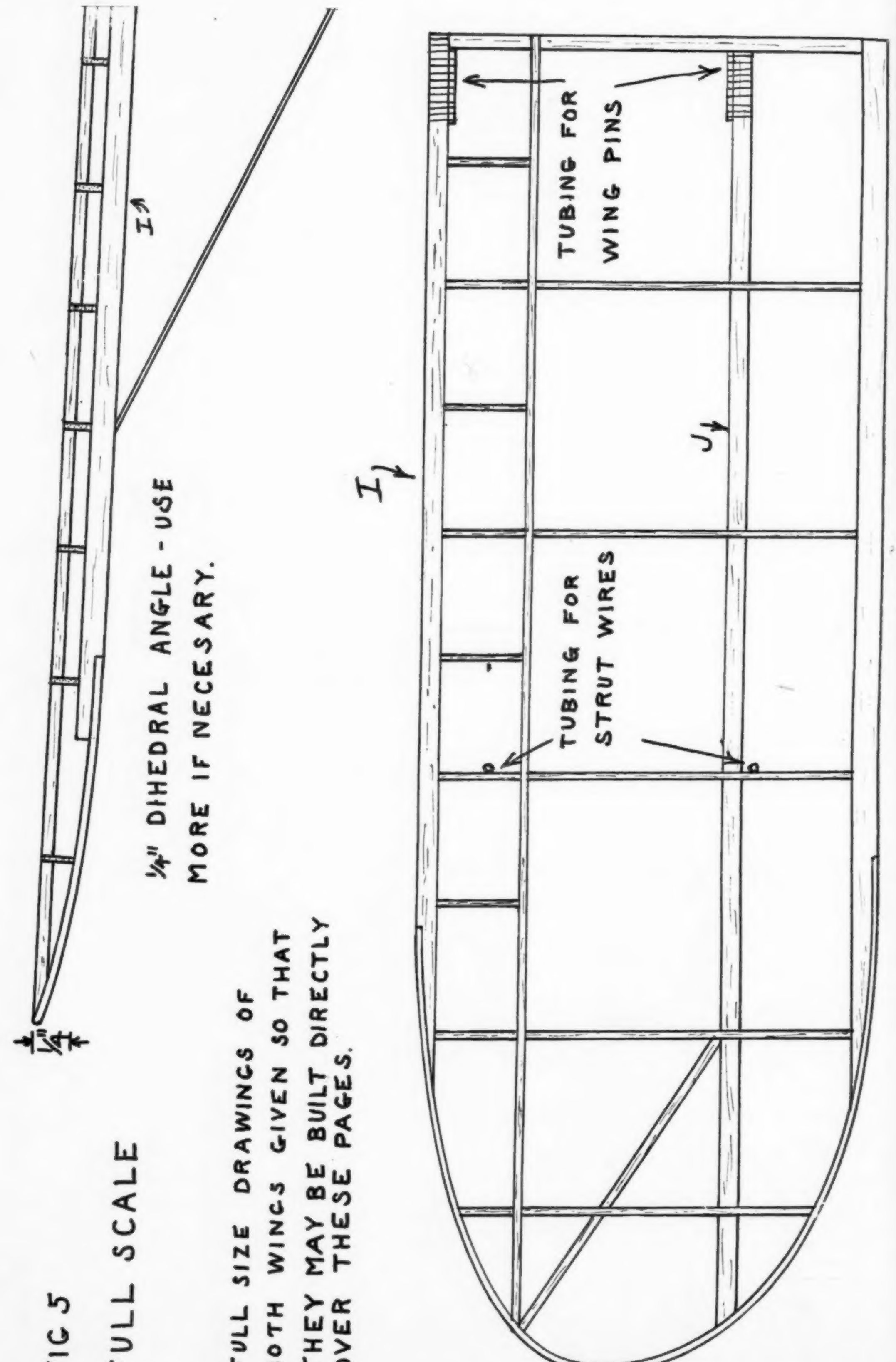


FIG 5
FULL SCALE
FULL SIZE DRAWINGS OF BOTH WINGS GIVEN SO THAT THEY MAY BE BUILT DIRECTLY OVER THESE PAGES.
1/4" DIHEDRAL ANGLE - USE MORE IF NECESARY.
1/4"
I
I
J
TUBING FOR WING PINS
TUBING FOR STRUT WIRES

"Whats" and "What Nots" of Model Plane Building

Some Helpful Hints on Strut Construction and Methods of Attaching Them in Place

By Howard G. McEntee

A COMPLETE consideration of airplane struts would take many pages indeed as they are numerous and varied. Hence we shall take up only the most important, starting with biplane interplane struts. There are three main types of these —the plain double type, the N type and the I type. These are illustrated in Fig. 1. The N type is most common now, since it is the predominant strut style used in large ships. The I strut is used chiefly in biplane racers.

The I strut must, of course, be completely cut out before assembly, but the N strut may be either assembled first and glued in place or the three component pieces can be assembled right on the model. The writer is inclined to favor the latter method, although, of course, either one or the other may be easier for a particular model.

In laying out any strut system, draw a side view just as shown in Fig. 1, with the correct angle of incidence for each wing. If your struts on the finished model are perpendicular, this is the only drawing needed. Most struts, however, slant more or less outward at the top, so this necessitates another drawing, one showing the front view of the wings, with the proper dihedral in both wings. From this front view, you can get the total height of the struts, while from the end view mentioned above you get the angles and spacing of the various pieces. Naturally, if you have a complete drawing of the ship, all these lengths and angles may be taken off directly from it.

FIG. #1

If you desire to build your N struts directly on the ship, you need only to know the proper setting for the wings. Then hold them in this setting with blocks or any convenient way and build the struts up, using pins to hold the pieces in place while gluing. The diagonal piece always goes in last and it is best to let the two main uprights dry thoroughly first as the diagonal sometimes has a tendency to pull the assembly out of shape, particularly if it is a trifle too long.

The plain style struts may be assembled just as directed for the N struts, leaving out the diagonal.

The I strut must be cut to fit and may be glued to the sides of the wing ribs or directly to the top. The latter requires a more exact job of fitting.

Any of the three strut styles given can be made removable from the wings, and this is very desirable if the wings themselves can be removed from the fuselage. Otherwise it is much more advisable to glue the struts solidly in place.

Several means of employing removable struts are shown in Fig. 2. At A is shown the simplest and the one which is most desirable on very light models which have struts of circular cross-section. The strut end fits in a socket glued to the rib, the socket being made of rolled and glued paper, or of radio "spaghetti." This method, while not as neat as the one to be described, is by far the lightest in weight.

At Fig. 2, B, we have a method using wire and aluminum tubing. The tubing for any model up to 30-inch span may be 1/16" O. D., and is glued onto the ribs or spars of the wings. The struts have pins or pieces of wire bound and glued to their ends. The wires are small enough to fit easily into the tube and may be bent slightly in the center to make them hold well in the tubes. This construction is to be recommended, as it is the neatest and lasts the longest. At Fig. 2, C, is shown another popular strut end fitting. This consists of cork pieces glued onto the wing, while the struts have pins glued and bound on their lower ends with the points downward. The cork holds the pins quite firmly.

All these movable schemes allow the wing tips to be adjusted for performance to counteract propeller torque or wing heaviness or to produce curved flight. This is especially true of the N type, as this is naturally much more rigid than the plain strut type. The I strut does not lend itself as readily to these removable systems, the only practical one to use being that at Fig. 2, B. Here a single piece of wire could be glued to the bottom of the I strut with both ends of the wire bent downwards to slip into the tubing.

Center section struts come under the same classifications as do wing struts, although the I strut is rarely used this way. The struts may be assembled the same also, but it is much more desirable to have at least one end of center section struts firmly fastened to give rigidity to the structure.

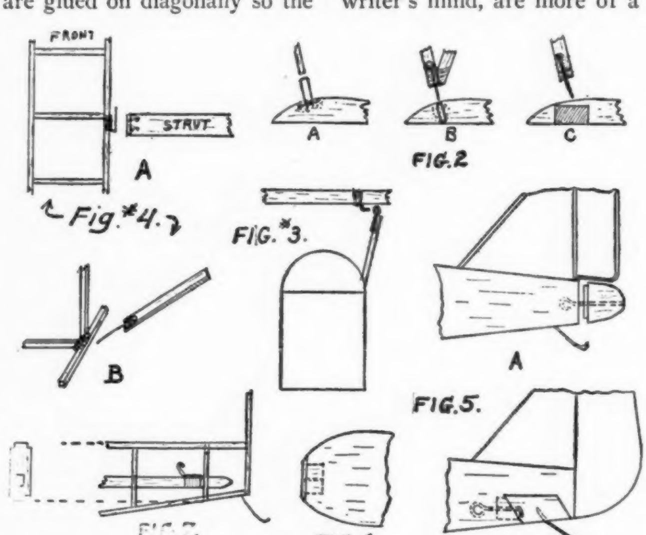
The best way of all is to employ a construction just as is used in large ships—that is, have a regular separate center section, so that both ends of the struts may be firmly fastened, thus making a good, strong construction. The methods of fastening the wings to the center section have already been given.

If you do not wish to use a separate center section, glue the struts firmly to the fuselage and use hooks at the upper ends to fit in wire pieces glued to the wing as shown in Fig. 3. The struts are springy enough to allow them to bend inward when putting the wing in place.

THIS about covers the subject of wing struts for biplanes. Now we must consider monoplane struts. Of course, in high wing monoplanes, the center section is arranged with struts just as a normal biplane.

The three main types are V, N, and straight double. These are almost self-explanatory, but we must have a few words regarding the methods of fastening them. Naturally, when the wings are non-removable, the job

is a simple matter of gluing. However, for removable wings, we must also use removable struts, which involve the use of various fittings. Fig. 4 shows some of these. At A we have a simple scheme employing the ever-handy aluminum tubing and wire. The tube is glued to the strut, while the wire is fastened to the fuselage. The same system is used on the outer end of the strut, but then the wire is fastened to the wing structure. Another method, which is more permanent and also which allows a small amount of adjustment, is shown at B. Here the tubing is fastened to the fuselage and wing. Soft copper or brass wire is used on each end of the strut, leaving an inch or more to stick out at each end. The wire is pushed through the tubing and bent over at the other end. Naturally, the tubes on the wings must go right to the upper surface and they should be vertical. Those on the fuselage should be fastened next to an upright and crosspiece as shown, and are glued on diagonally so the wire may come out at the bottom of the fuselage to be bent over. Adjustment of wing incidence can be made at either front or rear strut and a bead or two should be slipped on the wire between the strut end and the wing tube, so that the adjustment will be permanent. Soft wire *must* be used because it has to be bent a good many times, and hard or music wire not only would break but there would be a good chance of breaking the framework while bending it.



There are, of course, dozens of other schemes for fastening struts, any of which may be as good or better than those described. However, the ones given have been tried and proved efficient in service.

It is always best to bind the pin or wire to the strut ends or framework. It is also desirable to bind the tubing before gluing, although not necessary, because the tubing is large enough for the glue to get a good hold, especially if it is first roughened with a file.

As a rule, struts may be made entirely out of balsa, streamlined to proper shape with sandpaper. If a model is rather heavy, or if it is a fast flier or racer, it is safer to use a small strip of bamboo at the front with balsa glued to the rear for streamlining. This naturally makes a much sturdier strut but necessarily adds weight. Spruce can also be used for struts where balsa is not considered strong enough.

Some ships have struts which are quite wide and these often have an airfoil shape to add some lift. Also, being at a large angle to fuselage, they add stability, for the effect is that of a small wing with very large dihedral. On models, these struts are made of balsa sanded to the proper shape. They should be very thin because the extra lift is not needed, while the drag introduced by their use is a great drawback to good performance. Since the tendency to twist is greater as the strut width increases, the best method of fastening these wide struts is that shown at Fig. 4, A, as this prevents twisting more than most others.

In all cases where struts are to be glued solidly to a framework, a good deal of work can be saved and a much better job secured by first covering the part of the structure that the strut fastens to, then cutting holes and gluing the strut in place afterwards. As an example, when making a biplane, cover the bottom of the upper wing and the top of the lower. Then with a razor point, cut the paper just enough to install the struts. When dry, trim them off top and bottom and finish covering. In this way, all tedious fitting of paper around the struts is eliminated and a neater job is assured. The same method may be used on the fuselage for center section struts, landing gears, or any other parts which must pass through paper covering.

Of course, where the pin or wire method of fastening struts is employed, the above precautions are unnecessary as the pins can be pushed through the covering accurately after it is in place.

This about covers the subject of struts, which, to the writer's mind, are more of a nuisance on a model than anything else, especially since they are seldom necessary for strength, but only for appearance. However, we must have accuracy in our models.

NOW is as good a time as any to describe various constructions for motor sticks. The simplest is, of course, the single stick model in which the motor stick is fuselage and all. However, for regular fuselage models, the motor stick is simply a removable spar which carries the rubber, propeller hanger, propeller, and sometimes a radiator or nose piece.

The writer greatly favors the use of motor sticks, even though the construction may be slightly heavier. In the first place, almost all breakage of rubber—that is, breakage wherein the whole motor parts at once—occurs during the winding of the model. If this winding is being done with a motor stick removed from the fuselage, the only serious consequence is a crack on someone's fingers. If the same break occurs inside the fuselage, an unbelievable amount of damage can result.

The ease with which you can wind or work on the motor is alone a big factor to cause the adoption of the motor stick system. The weight may be slightly more, but even this is not certain as a fuselage without a motor stick must be made much heavier to stand the pull and twist of the rubber. There is just one type of construction which is not favorable to the employment of a motor stick, and that is the hollowed-out balsa construction. Here the shell is plenty strong enough to stand the rubber pull and in addition there is no delicate construction to be broken if the rubber snaps. A tail plug is always used for such a model which, with the movable nose piece or plug, allows the motor to be worked on. It is somewhat of a nuisance to have to thread the rubber through the fuselage with a wire, but one gets used to it.

While on the subject of tail plugs, a few words will be given on their arrangement. In cases where the rear end of the fuselage may come off—that is, where the rudder is entirely above the fuselage as in the Boeing Bomber—the tail plug forms the rear end of the fuselage. Fig. 5, A, shows this type (*Continued on page* 40)

Lieut. Alan McLeod—Bomber

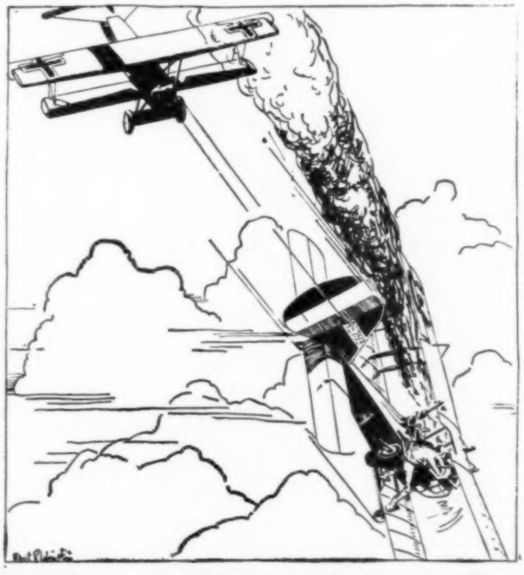
How McLeod Cheated Death when his Plane Caught Fire in Mid-Air Under a Fusillade of Shots from Enemy Guns

By F. Conde Ott

AVIATION'S annals of war activities list hundreds of brilliant heroes. Some are famous for long, arduous careers of unfaltering duty, others for outstanding heroic achievements and still another group for their exceptional displays of sacrifice for a fellow flier. In the latter group, perhaps, belongs the name of Lt. Alan Arnett McLeod, British Royal Air Force, to whom was awarded the most highly prized possession of the English fighting man—the Victoria Cross.

The word "perhaps," as employed in the foregoing paragraph, is used advisedly, for certainly Lt. McLeod's brave career was not without the other qualities that were deemed the requisites of an all-around, first-class war pilot. However, the single instance for which he was awarded that most honorable token of national appreciation is not only the outstanding one in McLeod's own career but a distinctly brilliant contribution to the records of brave deeds in general, worthy to rank with the highest.

McLeod had seen much distinguished service at the Front, being variously engaged in scouting, bombing and reconnaissance work. His general duties also included no small amount of air fighting. Thus he had behind him a rich experience in practically all the phases of air duty and was a veteran in every sense of the word. This diversified career had given McLeod excellent training in meeting quickly and well the unforeseen and perilous conditions that can so suddenly arise to plague the sky raiders at their hazardous work. Under these conditions, it was only natural that this brave and unselfish man should rise to the heights of extreme heroism when fate knocked at the portals.



McLeod throws his ship into a side slip by climbing out on one wing, thus deflecting the flames.

In the early spring of 1918 the Germans had opened a desperate and sustained offensive against the tenacious Allied lines on the western Front. Wave after wave of field-gray humanity poured forth in the last hopeless effort of the German General Staff to smash the foe at a crucial point. The Allies in turn realized only too well the grim purpose of the foe and the unfaltering determination with which this great offensive of the Boche would be carried out. It must be stopped at all costs, and so every branch of the Allied service was pressed into active duty.

While the infantry in the mud-filled trenches took the direct shock of the hand-to-hand combat, the artillery lent its splendid aid with a continuous bombardment that stopped much of the enemy's momentum before it ever got under way at the German lines. These two vital branches fought gallantly indeed to stem the tide of gray. But their brothers in the sky helped, too.

There was no rest at all for the Allied airmen in this great German offensive, for not only were they called upon to spot out Boche movement but also to harass the progress of the enemy by bombing troops and munition trains that were constantly bringing up reserves and supplies so necessary to the consummation of the project.

This was a herculean task at the time, for the Germans had planned their campaign well and were most strongly prepared to resist all air invasions that might be sent against them. The concentration of Boche aircraft on the western Front at this time was just about the heaviest of the entire war. Groups of ten, twelve or even twenty patrolled the sky continuously, awaiting Allied fliers. On top of that, anti-aircraft guns studded the ground below as thickly as daisies in a field in summer. Truly the Allied airmen had most trying odds to face. But orders were orders, and the orders were to "carry on."

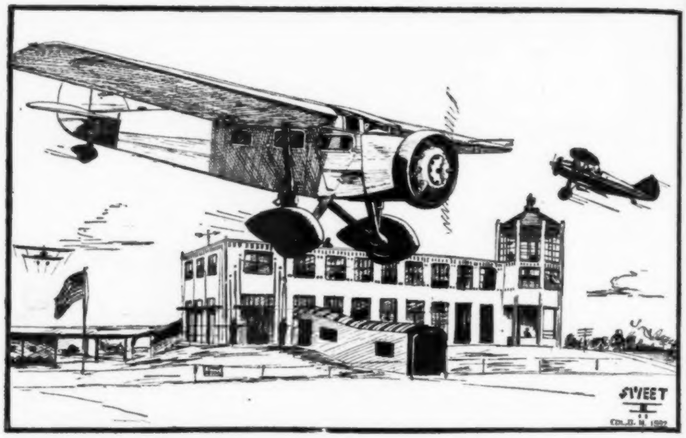
LT. McLEOD, at the time, was detailed to the bombing group. Particularly expert at this phase of the deadly game, his commanding officers felt that this able Britisher could serve best in the trying art at which he was so adept.

One morning, late in April, McLeod received orders to fly out behind the German lines at Amiens. Reports had come through the Intelligence Staff that the enemy was massing troops there. Packing into the heavy bomber with his observer, Lt. Hammond, McLeod set out for his objective far off to the east. He flew as high as possible with his heavy load of deadly missiles as he wanted to be well out of reach of the foreign anti-aircraft guns. The latter were wary of, and watchful for just such Allied enterprises. In fact, the extreme height at which McLeod flew, took him well out of the path of all other planes, both German and Allied, so that he succeeded in reaching his objective unmolested.

Sure enough! The Boches were streaming toward the Front in droves. They came on foot, by motor and in troop trains. The gleaming lines of steel that converged here from all directions were particularly hard pressed, for over them, too, rolled the vital supplies of food and munitions. What an ideal setting for a load of high explosives, thought McLeod, as he peered down from the dizzy heights. To make his shots effective, however, he would have to dive considerably lower for more precise aim. This maneuver would, of course, invite a retaliating attack from the German (*Continued on page 37*)

AIR WAYS—Here and There

Get Busy and "Air Your Ways" of Building and Flying Model Planes. In This Column, Space will be Devoted to the Activities of Our Readers. Let Others Know What You Are Doing



THE most important incident that we have to tell you about this month is the Eastern States Model Airplane Meet, which was held at the 69th Regiment Armory, New York City, on December 29 and 30. Considering the depression, the entry list was fairly large. One hundred-seventy applications were received. However, only one hundred-fifteen young men actually took part in the event.

The two outstanding points in regard to this meet were: First, the performance of Herbert Owen's Baby R.O.G., which broke the world's record with a ground take-off flight of 7′ 29 4/5″. This young man came all the way from New Britain, Conn., to win honors. For this remarkable feat, he was awarded a beautiful trophy donated by Mr. Frank Titchenor of the *Sportsman Pilot* magazine and *Aero Digest*. The remarkable feature of this little machine was that it was completely covered with microfilm. (The only possible improvement that could be made would be to have it wrapped in cellophane.) The construction was of the finest. Owen certainly has made a name for himself as a model builder.

The second interesting feature of the meet was Carl Goldberg's consistent performances in all three events. Goldberg took first place in the meet as high point winner, receiving a beautiful trophy donated by UNIVERSAL MODEL AIRPLANE NEWS. By winning second place in the endurance contest, he won the trophy donated by Scientific Model Airplane Company, Newark, N. J. In the R.O.G. Fuselage contest, he took fourth place, for which he received a gold medal. In the Baby R.O.G. contest, he placed second with a flight of 6′ 12″, for which performance he received a gold medal. Consistent performance is the true test of anyone's ability to build successful model airplanes. In this respect Carl Goldberg is to be commended. He places well up among the winners consistently in all meets. Picture No. 1 shows Goldberg with the prizes he won in the Eastern States Championship Meet and many other prizes which he has won in the past.

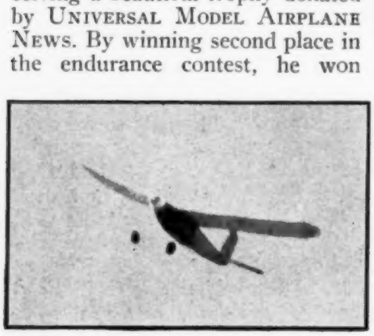
Picture No. 1. Carl Goldberg and trophies he won at Eastern States Contest

Picture No. 2. The Phantom Model Club of Los Angeles and some interesting models they have built

On the first day of the meet, the weather was clear and the air conditions were excellent for flying. However, on the second day it was quite stormy and damp, which probably was the cause of the poor time recorded in the endurance contest which was held on that day. This contest was won by George Schweigart of National Park, N. J., with a flight of 10′ 45 2/5″. Schweigart won the trophy donated by the Brooklyn *Daily Eagle*.

Another consistent winner in most meets is John Zaic, who won first place in the R.O.G. Fuselage contest with a flight of 6′ 57 1/10″. He won the trophy which was donated by The Balsa Wood Company of Brooklyn, New York.

The following list shows the winners of the first ten places in the three events of the meet:



Picture No. 3. A seven-foot compressed-air model in flight. Built by Henry Jewett of the Phantom Club.

Picture No. 4. A group of planes built by Henry Jewett. Note the miniature model on the right wing of the large twin-motor ship.

Picture No. 6. Harry Trimble did an excellent job in building this Curtiss Falcon

BABY R.O.G.

1st	Herbert Owen	7' 29 4/5"
2nd	Carl Goldberg	6' 12"
3rd	Frank Zaic	4' 55 1/2"
4th	Henry Runkel	4' 47 1/10"
5th	Laurence Smithline	4' 40"
6th	John Young	4' 38 3/5"
7th	Francis Schaider	4' 35"
8th	William Umfrid	4' 31 4/5"
9th	Henry Orzechowski	4' 26 1/3"
10th	Frank Ehling	4' 25 2/5"
11th	Hy Kessler	4' 15"
12th	Allan Penn	4' 14"

R.O.G. FUSELAGE

1st	John Zaic	6' 57 1/10"
2nd	Joseph Kovel	5' 24"
3rd	John Young	5' 15"
4th	Carl Goldberg	5' 4 3/5"
5th	Laurence Smithline	4' 37"
6th	Frank Zaic	4' 31 4/5"
7th	Henry Orzechowski	4' 08"
8th	Emanuel Radoff	3' 52 2/5"
9th	Jerome Kittel	3' 45"
10th	Herbert Owen	3' 36 1/5"

ENDURANCE

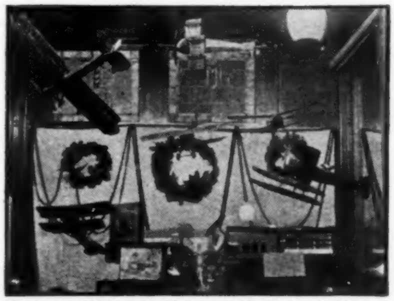
1st	George Schweigart	10' 45 2/5"
2nd	Carl Goldberg	9' 15 1/5"
3rd	John A. Bartol	8' 37 4/5"
4th	Francis Schaider	8' 19 1/5"
5th	Wilbur F. Tyler	8' 19"
6th	Allan Penn	8' 12 2/5"
7th	Jerome Kittel	8' 07 1/2"
8th	Laurence Smithline	7' 53 1/2"
9th	Fred Korn	7' 37 2/5"
10th	Emmanuel Enderlein	7' 31 1/5"
11th	Leon Haynes	7' 20"

There is one word of criticism which your Editor wishes to make with regard to the manner in which a certain group of young men participate in all meets which they enter. The success of the meet and the pleasure of the majority of boys may be increased by the conformation of these young men to certain rules which must be set for the benefit of all who enter the events. In order that everyone may have an equal and fair chance to win prizes, these rules of the meet must be inflexible, not favoring any particular person or group. A few young men are inclined to feel that they deserve or should have special privileges. On a basis of fairness to all, this is absolutely impossible. I suggest, therefore, that each one of the entrants who read this consider his attitude upon entering all contests and, in the name of good sportsmanship, take misfortune graciously when it comes.

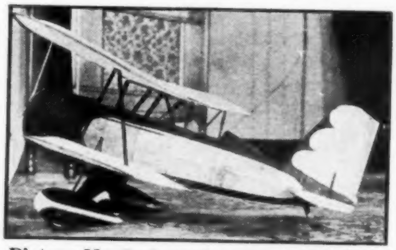
It is well to keep in mind that a model airplane contest is not only a test of the ability of the machine to make a long flight, but is a measure of the flying ability of the young man who is flying the machine. Many machines which were capable of long flights made very little time only because of the fact that the young man who was operating it did not show a thorough understanding of flight principles and how to adjust his plane for the conditions which were to be met.

Picture No. 8. Here is a Puss Moth with a wing spread of 8½' that flies beautifully, by Louis Andrews.

Picture No. 5. Here is a cleverly-built Bellanca by Harry Trimble



Picture No. 12. Robert Smith of Norwich, New York, rents his models for display purposes.



Picture No. 7. A neat, composite biplane that flies well, by Ken Willard.

Picture No. 9. K. E. Laumer built this Taylor Cub for the Taylor Aircraft Corp. It is now in a collection at Washington, D. C.

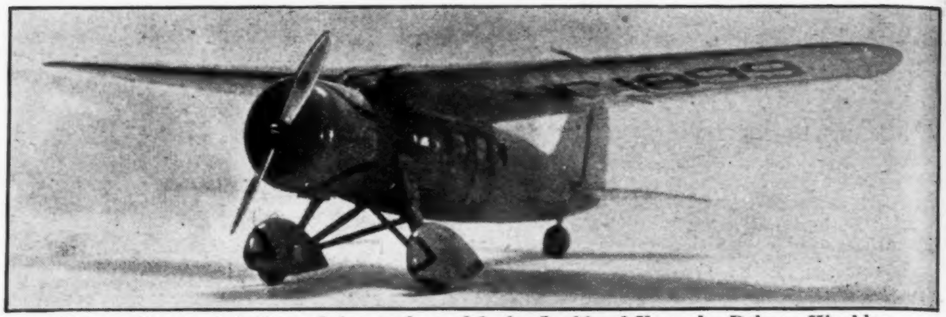
ROBERT SWEET of Columbus, Ohio, has honored us with another excellent drawing for our Air Ways heading, which shows a Cessna dropping in to the Columbus airport. I am sure all readers appreciate Sweet's work.

Henry J. Jewett of 3855 South Flower Drive, Los Angeles, Calif., sent us several interesting photographs of model activities in Los Angeles. He is a member of the Phantom Model Airplane Club of his city. This club built the seven-foot wing-spread, compressed air model shown in Picture No. 2. Jewett contributed the other machines shown here. Unquestionably they make a very formidable array. This seven-foot model is a very well designed machine, and Picture No. 3 shows very clearly that it has excellent flying qualities. In Picture No. 4 is shown a group of various types of models that Jewett has built. The twin model with the tail booms has a wing-spread

Picture No. 10. Laumer also built this beautiful model of a DO-X. Its span is 17-1/25 inches

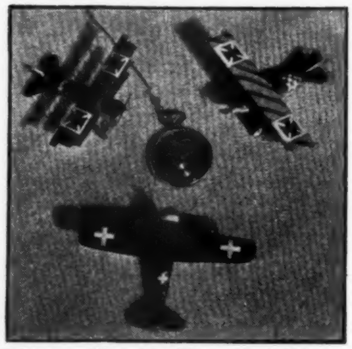
Picture No. 11. The skeleton of a cleverly-built Curtiss Hawk by an unknown genius

of 4′ 6″ and weighs about seven ounces. If you look closely at this picture, you will see a very small model of the Curtiss Hawk perched on the right wing tip of this twin-motor machine. One might call these the "Mutt and Jeff" of the model world. They certainly represent extremes in model construction.

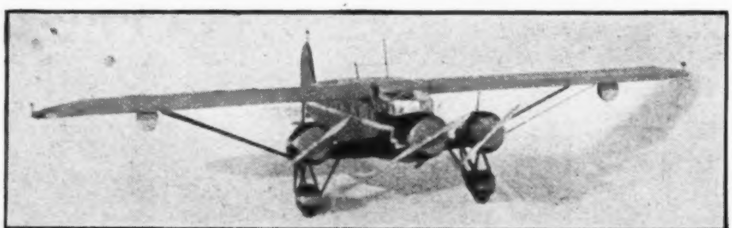


Picture No. 13. A built-up flying scale model of a Lockheed Vega, by Delmar Hinckley.

Pictures No. 5 and No. 6 of a Bellanca and a Falcon, respectively, have been submitted by our old friend, Harry Trimble of 9-B Forsyth Avenue, Fort Riley, Kansas. These two models are exceptional in their workmanship, but then Trimble has always been in the habit of turning out fine-looking machines. The Bellanca has movable controls and is a very good flyer as well. The Falcon will also fly but has no great duration because of its small size. Trimble suggests a remedy for poor pictures, of which we have received so many. As a matter of fact, poor photography on the part of our Air Ways contributors has been the cause for many rejections. Trimble says: "Buy a color filter for your camera, the color of which is a yellowish amber. When this is slipped over the lens, it will show up the colors of the machine in their true tone value." Do not take pictures in very bright sunlight. If you do, it will result in part of the picture being too light and other parts being so dark that details will not show.

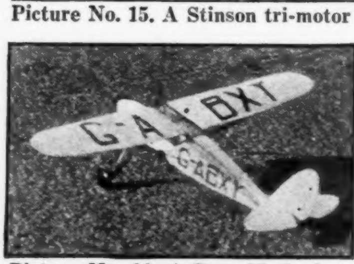


Picture No. 14. Three miniature war-time models, beautifully made by A. F. Kitchel, Jr.

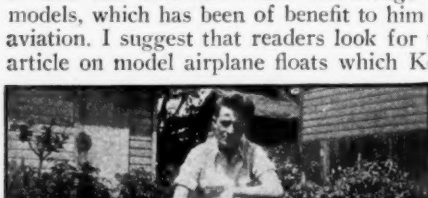


Picture No. 15. A Stinson tri-motor model in detail, by Robert Volckmann.

Ken Willard of 1734 Ridge Avenue, Evanston, Illinois, has submitted Picture No. 7 of his composite biplane. This ship was built to resemble a full scale machine, but modified slightly to attain excellent flying qualities. Willard is a senior in the Mechanical Engineering Course at Northwestern University. He is an ardent model builder and has obtained much knowledge through flying models, which has been of benefit to him in his study of aviation. I suggest that readers look for the very useful article on model airplane floats which Ken Willard has written for us and which will appear in a following issue.



Picture No. 16. A Puss Moth that has flown 1200 feet, by Joseph Camilleri.

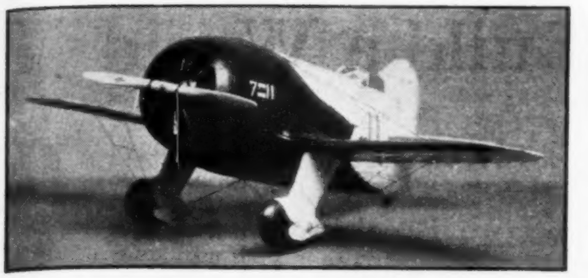


Picture No. 17. Harry Walker and a group of his neatly-built models. The Curtiss A-8 is a fine flyer.

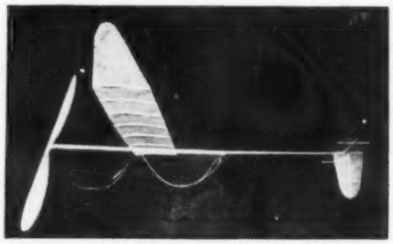
HERE is a young man who believes in doing things in a big way. Louis J. Andrews of 1124 Chestnut Street, Newton Upper Falls, Mass., has sent us Picture No. 8, which shows a Baby Puss Moth with a wingspread of 8½ feet. It has made some excellent flights and Andrews promises to send photographs of this machine in flight as soon as he can get his camera properly adjusted. This machine, without the rubber motor, weighs fourteen ounces complete. If model builders will build larger models they will find that there is much more enjoyment in model flying. Usually they are quite successful when designed fairly well. Large models in flight are very impressive and will afford their builders thrills which they can never hope to get while flying miniature models. Also in this way a most accurate study of the performance of different types of ships may be made.

We are honored by the contribution of K. E. Laumer of 145 South Avenue, Bradford, Pa., of Pictures No. 9 and No. 10, which show models of the Taylor Cub and DO-X, respectively. Laumer is an expert builder and makes a business of building scale models. The Taylor Cub was built for the Taylor Aircraft Corporation to be put in the U. S. collection at Washington, D. C. It has been constructed to a scale of 1/25 as specified by the Department of Commerce. It contains all control details such as dual controls, throttles, rubber pedals, seats upholstered in imitation leather, stabilizer control and a choke control. The motor represents a Continental A-40 and has eighteen parts. The span of the model is 17 1/25 inches. Laumer tells us that the DO-X was built from plans published some time ago and, although not authentic, produces a very attractive model.

Picture No. 11 shows the framework of a flying model of a Curtiss Hawk. It is a very neat piece of work and we regret extremely that we cannot give you the name of the builder. He has either neglected to send us his name or else we have lost the letter which came with this picture. We do know, however, that he lives in Salem, Mass.



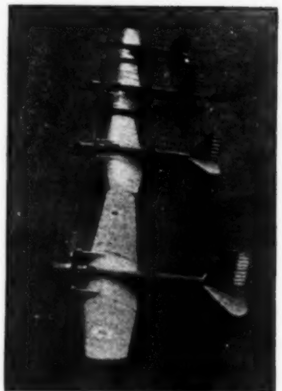
Picture No. 18. A model of Jimmy Doolittle's famous Gee-Bee, by Roy Marx. It is complete in all details.



Picture No. 19. An excellently-built endurance model weighing only 0.225 ounces, by John Hastings.

Will not the builder of this model write to us and disclose his identity?

Picture No. 12 shows a group of models built by Robert Smith of Norwich, New York. Readers can see that Smith is a very progressive young man as he is making good use of his model-building talent. This was a display in one of the stores of his city which helped to make the Christmas season most attractive and profitable for the organization which used it.



Picture No. 21. A fleet of four Boeing Bombers built by a Milwaukee model club

Picture No. 13 shows a very neatly built Lockheed Vega, which was made by Delmar Hinckley of 939 Schaaf Road, Cleveland, Ohio. Hinckley has not written us, giving any details of this ship. However, our model-building sharks can possibly glean some useful information regarding its construction by examining the picture closely.

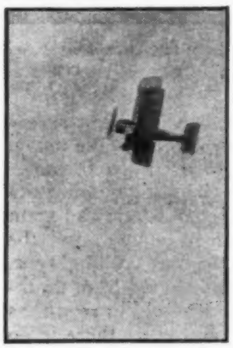
Picture No. 20. A Fokker Triplane model, one of twenty-five models built by Herbert Weiss.

A. F. Kitchel, Jr., of Old Greenwich, Conn., has sent us a very interesting picture, No. 14, of a group of three of his miniature World War models arranged about an ordinary watch, which gives us some idea of their actual size. To make models as small as the ones shown here requires very delicate workmanship, as many of you have probably found out. Kitchel says that these are only a few of a set of twenty which he is building. When they are finished, they should make a very interesting display, and I suggest that he send us a picture of all twenty of them when they are completed.

ROBERT VOLCKMANN of 149 Hillcrest Avenue, Cranford, N. J., is the creator of the built-up scale model shown in Picture No. 15. It is a Stinson tri-motor and is unusually complete in detail. Close examination will show riding lights, wireless masts and aerials. From the picture, we should judge that his workmanship is unusually accurate.

Here we have something for you flying scale model builders to shoot for. Picture No. 16 shows a model of a Puss Moth built by Joseph Camilleri of 1703 86th Street, Brooklyn, N. Y. As far as looks are concerned, this model is like many other excellent ships. However, as a flyer, it surpasses most of those about which we have heard. Camilleri tells us that it is a perfect flyer, has excellent stability and takes off and lands like a large ship. It has flown 1200 feet. This flight was made in a thirty-mile wind, the ship attaining an altitude of 150 feet. On one hand, the thirty-mile wind helped this model to fly a long distance but, on the other hand, it was certainly a handicap, for if the ship did not have perfect stability, it would never have been able to ride out such a gale. The machine has a wing-spread of 30 inches and is 18 inches long. Joseph tells us that it took six days to complete.

Harry Walker of 5703 Mound Avenue, Cleveland, Ohio, sends us Picture No. 17. Walker is shown surveying his handiwork, which consists of a very neat group of models. He tells us that the Curtiss A-8 Attack was built from plans by Mr. McEntee and which appeared in the magazine. As might be expected, Walker says that this ship is an excellent flyer. All four of the models in this picture show excellent workmanship and cannot help but impress one with the idea that aerial transportation could be highly developed when young men such as Walker, of which there are many in this country, get into the aviation business.



Picture No. 23. A model S.E.5 in flight, built by a Danvers, Mass., Model Club member.

Picture No. 18 shows a carefully-built model of Jimmy Doolittle's famous Gee-Bee that won the 1932 Thompson Trophy Race. This machine is complete in every detail, even to wire spreaders, Smith adjustable pitch propeller and the lettering on the pants and, considering the fact that this airplane has pants, *(Continued on page 43)*

Picture No. 22. Members of the Model Club of Danvers, Mass., and some of their model ships.

How You Can Build a World Record Glider

The Account of a Record Breaking Flight with a Model Soaring Glider and How it May be Easily Constructed

By Ted Bellak

THE story of the record flight of this thermal glider may be told best by quotations from the author's diary.

"June 5, 1932. Two-thirty p.m.

"Today it is exceptionally warm. Not a breath of air is blowing. We deduce from this that the advanced glider students of the Aero Club Albatross will be catapulted from an adjacent hill. As preparations are being made, I get my glider which was repaired by an obliging member and proceed to tow it into the air. As there isn't any wind I am prompted to run as fast as my legs can carry me. After towing the model to an altitude of about 75′ I release it, as my energy is spent. The ship descends a trifle, then immediately starts to ascend, spiralling slowly but surely upward. It is at this stage of the flight that I take notice of the conditions under which the model is performing. There are no clouds whatsoever in the sky; humidity is low as the air is quite dry; there is no wind; radiation of the heat waves is visible to the naked eye and the terrain over which it is flying is of the gentle 'rolling' type.

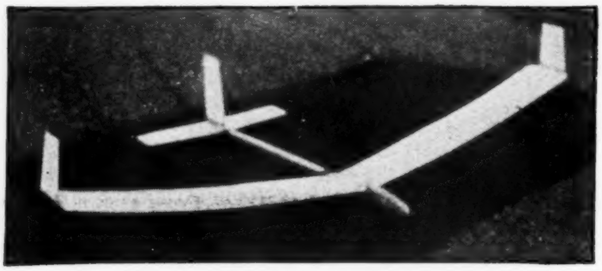
"The model is rising higher and higher and I am thinking of pursuing it. Two automobiles are held in readiness should it decide to go 'cross country,' but as there is no wind, the model travels about 1000′, turns, retraces its previous course and comes back again, all the time going higher and higher, until it has approximately 600′ to 700′ altitude. It is here I think that I shall never see the glider again.

"There is a small brook with trees running parallel to the model's course. Every time the ship passes over it, the glider descends a little until it is about 100′ high. Then suddenly it rises to 150′, due to a strong 'bump' caused by the trees which are giving off some of their previously retained heat. It does this a number of times until it aggravates me and prompts me to throw missiles at it in the hope of retrieving it.

"Eventually it lands on the right side of the brook and trees, unharmed, after gliding persistently on the left side.

"Duration, as clocked by two stopwatches, is ten minutes and thirty-three seconds from the time it was released from the tow string.

"This flight to the best of my knowledge is the first pure thermal soaring flight ever accomplished by a model glider and is considered an unofficial but authentic world record, being witnessed by members of the Aero Club Albatross."



The six-foot soarer with a twenty-to-one glide, ready for a flight

"GOSH! I hope I get a break!" A colloquial phrase familiar to all outdoor contestants, especially where a record is to be beaten or a championship is in the balance: verbally familiar, however structurally ambiguous. According to grammatical form, if we diagram the above sentence, we shall find that the noun "break" is used as an object. It is around this object that the success of our flight hinges, a noun being defined as the name of anything. "Break" then specifically means "things that enhance the model's flight."

Vagueness presents itself when we question some as to what are the qualities they desire when asking for a "break." Majority will say "altitude, and a good gliding angle." True! these factors are advantageous for the flight in that they *prolong* it. However, without other attributes, an *exceptional* flight cannot be anticipated. The qualities the more rational builder looks forward to, we are informed, are atmospheric currents, heat waves, topographical features, etc. In other words, he depends upon his accumulation of meteorological knowledge for success. He tries, as far as possible, to build his ships to conform to this knowledge. Weather is indeed capricious! This element is one of many which must be conquered. Meteorology, then, is the basic principle of "freak flights," "luck," "breaks" and what have you!

The science of meteorology is a volume in itself, and as I am no authority on the subject generally it would be superfluous to discuss it. We shall, however, touch upon one phase of meteorology which is relative to the model described herein, and that is Thermic Soaring. Thermic or heat waves, as you know, are the result of the incessant beating of the sun's rays upon the earth. When the earth can no longer retain its heat, radiation takes place, thereby accentuating vertical currents of warm rising air. If the vertical current exceeds the sinking speed of our glider, soaring will take place. It is for us to construct a plane that will utilize to the best of its ability, the characteristics of a thermal current. The glider, I believe, is the best medium for experimentation, as it is economical, and forms a basis for checking model aerostatic theory.

Personal opinion and experience indicate that in order to accomplish thermic soaring, a model should contain the following characteristics: lowest sinking speed, best possible gliding angle, unusual longitudinal and lateral stability, minimum drag, slow flying speed, and general efficiency, especially in vertical currents. The glider described embodies these essential points and is admirably suited for thermic experimentation.

Instructions for Constructing

BEFORE you proceed to construct your model, may I suggest that you draw full size, on any flat wooden surface, the wing (No. 5, 5a), one auxiliary wing tip

(No. 10), rudder (No. 14), and stabilizer (No. 12). These composites used as jigs will insure proper alignment of all parts and make possible accurate construction throughout. Make also a metal template of wing rib (No. 9).

Wing (wing proper)

Cut to size, shape and fit the required number of ribs, spars, leading and trailing edges, so as to be ready for gluing. In doing this, notice *well* the construction in figures (6) and (7). For strength, the root ribs and final wing ribs [sections BB and DD respectively, in figs. (6) and (7)], are made of 5/8″ wide hard balsa, the end ribs being sanded however to a streamline form as indicated in fig. (6).

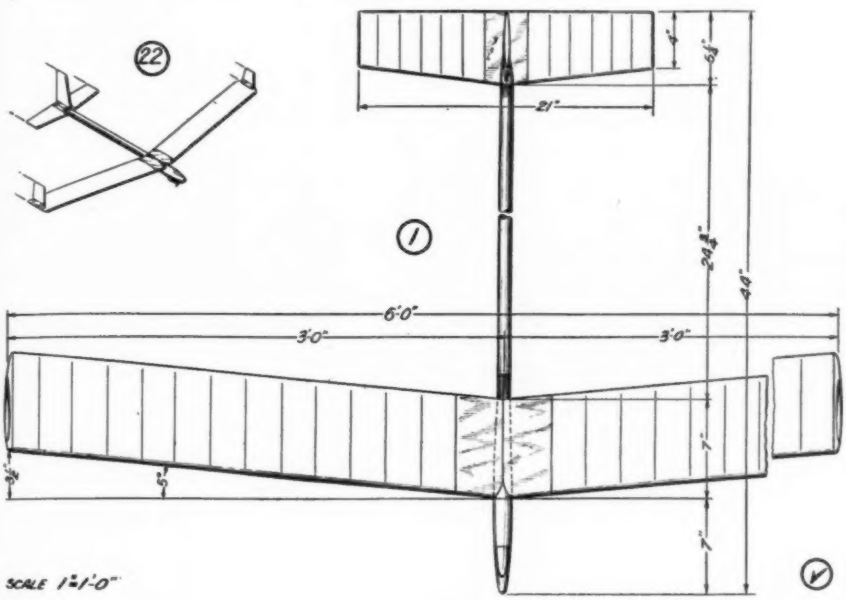
The sanding complete, cut angles 4½″ long, ¾ of an inch from the leading edge, to accommodate the auxiliary wing tips, fig. (10), which will be later attached. A U-groove 3/16″ x 3/8″ is now cut in both BB and DD figs. (6) and (7) for the center spar.

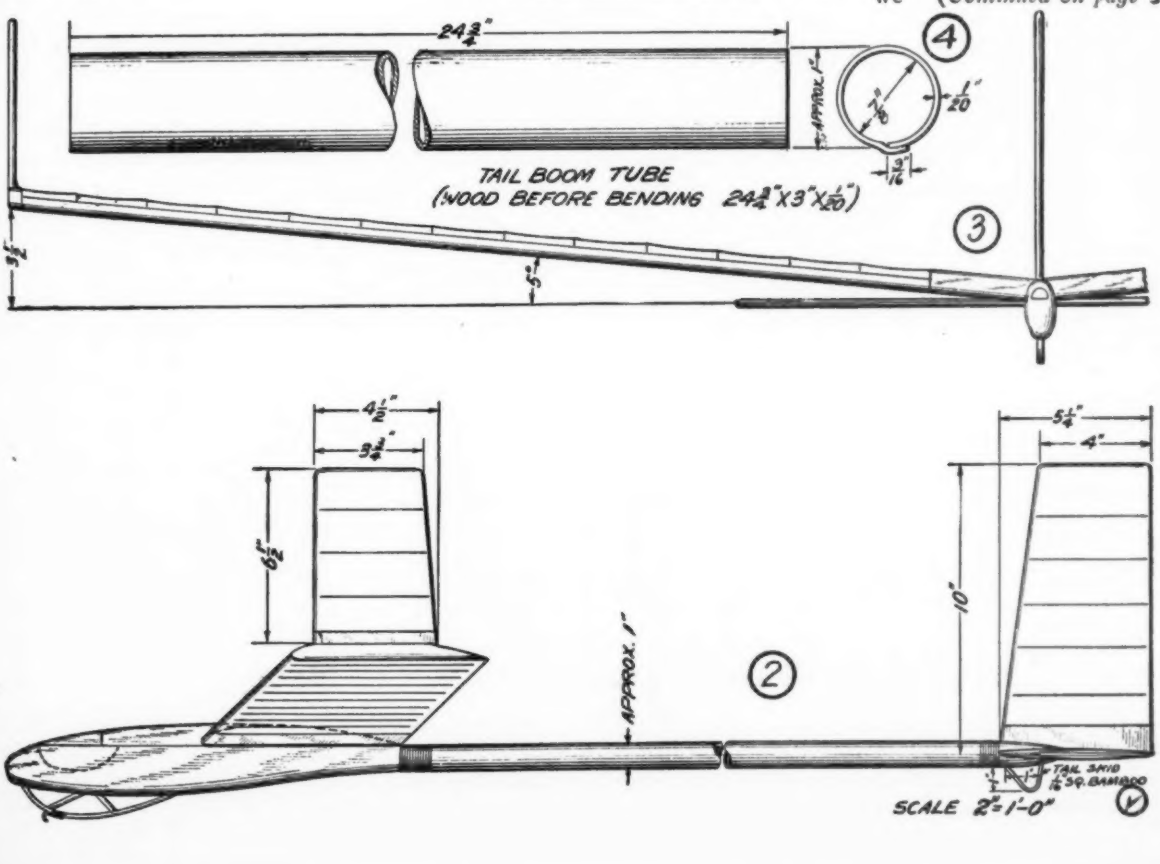
The entire wing being "free carrying," its weakest point is naturally the center or root. We must therefore make the center as strong as possible. To make an exceptionally strong root, cover top and bottom, the area from section BB fig. (6) to the next consecutive rib with 1/32″ balsa veneer (grain running parallel with the leading edge). This panel completed [also fig. (1)] becomes a torsion-proof box resisting admirably the forces of sheer compression and torsion.

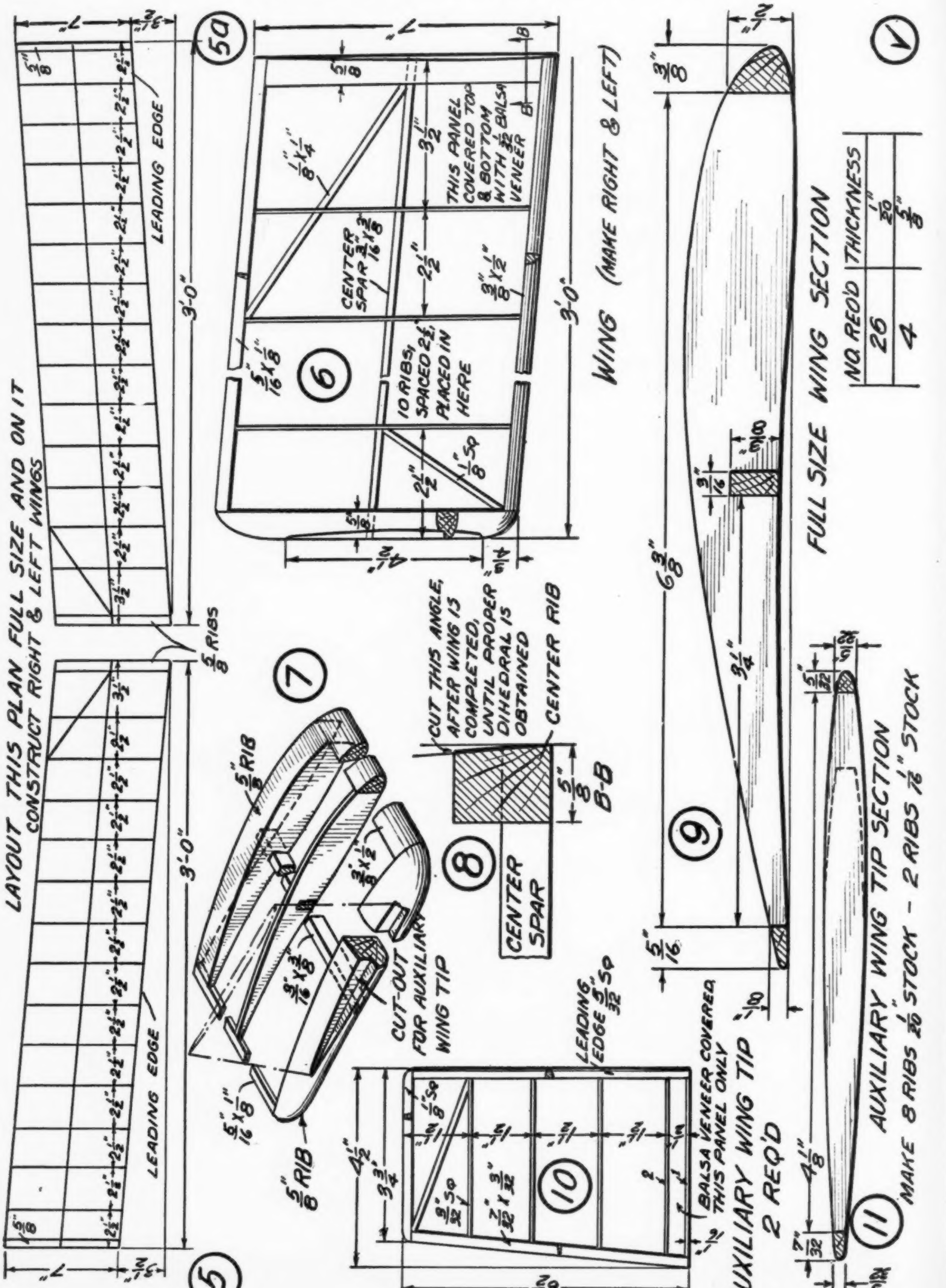
After allowing the wing to dry for about two hours, sand section BB figs. (6) and (8) so that it will give the wing 7″ of dihedral and 5 degrees of sweepback! Be careful, when joining the two wing panels, figs. (5) and (5a), that you scrape the joints so as to make a better gluing surface.

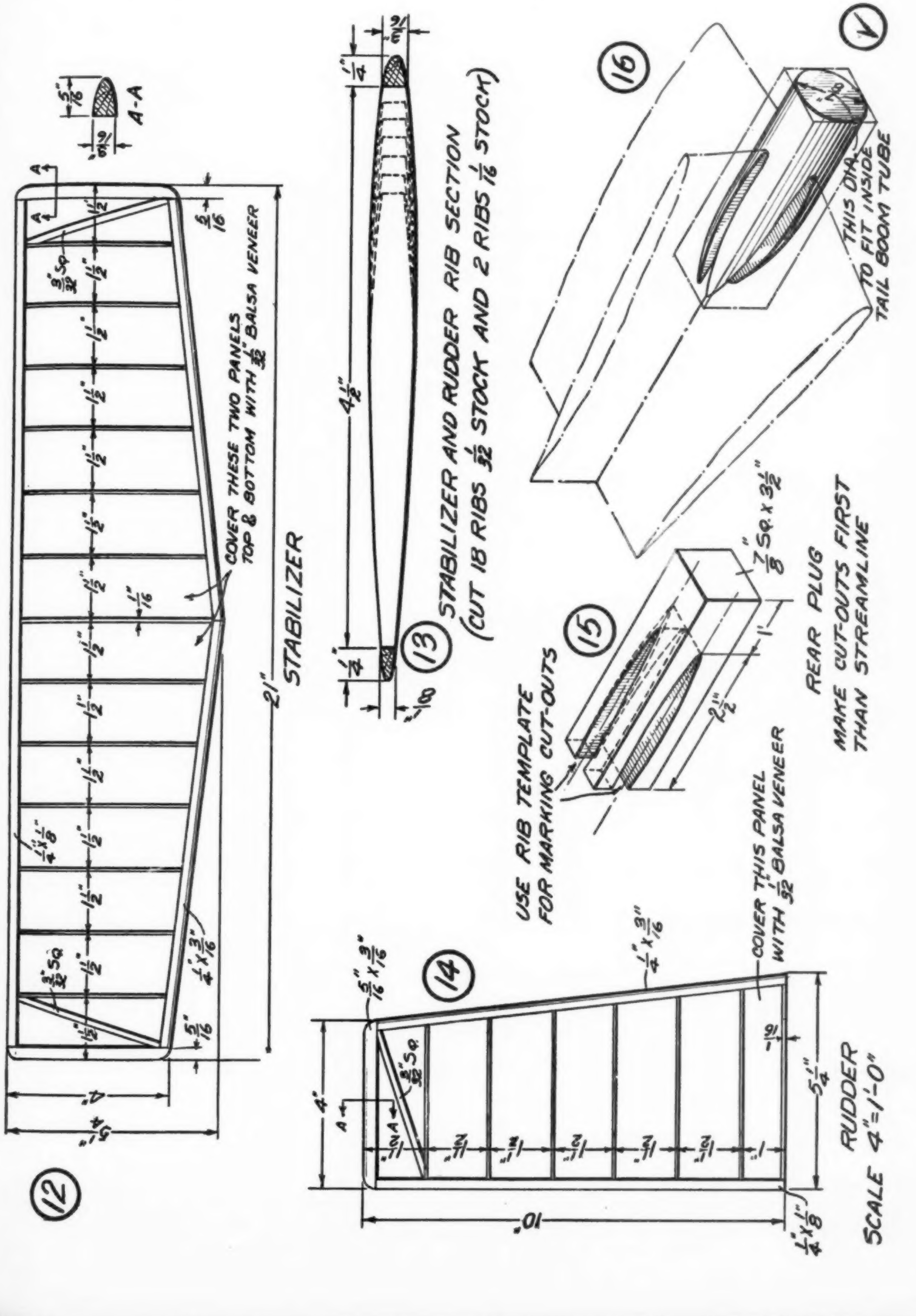
Wing (auxiliary wing tips)

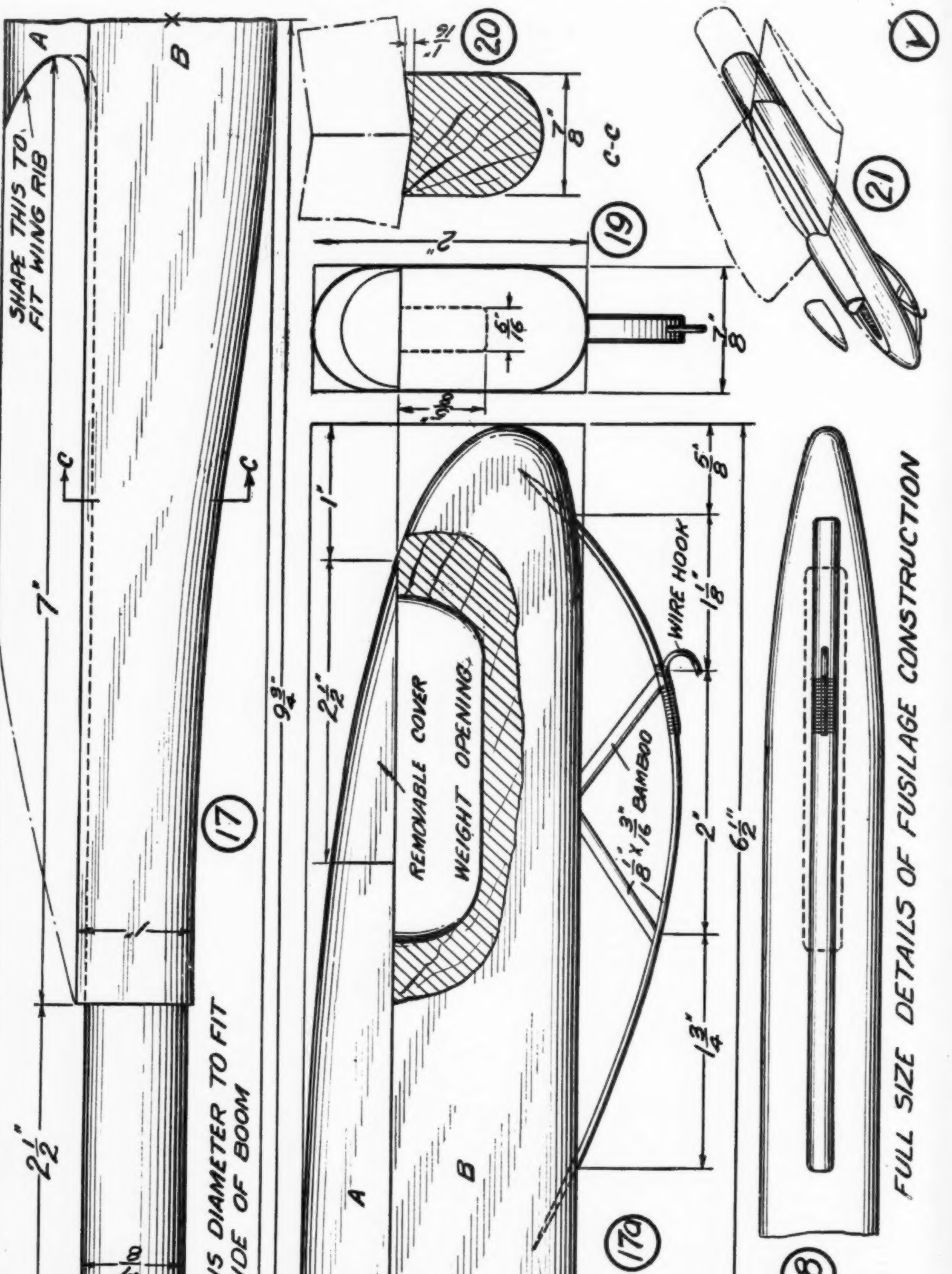
To make the wing complete, we (*Continued on page* 38)






LAYOUT THIS PLAN FULL SIZE AND ON IT
CONSTRUCT RIGHT & LEFT WINGS
LEADING EDGE
LEADING EDGE
5/8 RIBS
3'-0"
5
5a
6
WING (MAKE RIGHT & LEFT)
THIS PANEL COVERED TOP & BOTTOM WITH 1/32 BALSA VENEER
10 RIBS, SPACED 2 1/2, PLACED IN HERE
CENTER SPAR 3/16 X 3/8
7
5/8" RIB
CUT-OUT FOR AUXILIARY WING TIP
8
CUT THIS ANGLE, AFTER WING IS COMPLETED, UNTIL PROPER DIHEDRAL IS OBTAINED
CENTER RIB
CENTER SPAR
B-B
9
FULL SIZE WING SECTION
NO. REQ'D | THICKNESS
26 | 1/20"
4 | 5/8"
V
10
LEADING EDGE 3/32 SQ
BALSA VENEER COVERED THIS PANEL ONLY
AUXILIARY WING TIP
2 REQ'D
11
AUXILIARY WING TIP SECTION
MAKE 8 RIBS 1/20" STOCK - 2 RIBS 1/16" STOCK


12
STABILIZER
21"
COVER THESE TWO PANELS TOP & BOTTOM WITH 1/32" BALSA VENEER
A-A
13
STABILIZER AND RUDDER RIB SECTION
(CUT 18 RIBS 1/32 STOCK AND 2 RIBS 1/16 STOCK)
4 1/2"
14
RUDDER
SCALE 4"=1'-0"
COVER THIS PANEL WITH 1/32" BALSA VENEER
10"
15
USE RIB TEMPLATE FOR MARKING CUT-OUTS
7/8" SQ. x 3 1/2"
REAR PLUG
MAKE CUT-OUTS FIRST THAN STREAMLINE
16
THIS DIA. TO FIT INSIDE TAIL BOOM TUBE
V



FULL SIZE DETAILS OF FUSILAGE CONSTRUCTION

The Aerodynamic Design of the Model Plane

How to Obtain Directional Stability and Overcome That Spinning Tendency

By Charles Hampson Grant

Article No. 13 **Chapter III**

HAVING given you some ideas in the past few issues, showing how to overcome your problems in lateral stability, we are now ready to go on to the next step in our process of building a logical conception of Model Airplane design. It is to give you some useful and rather interesting facts and figures about Directional Stability. This type of stability has been defined as that tendency of an airplane to resist any displacement about a vertical axis through the center of gravity (swing of tail of the plane to right or left from the normal direction of flight), or the tendency to return to the normal flight position when once it has been displaced.

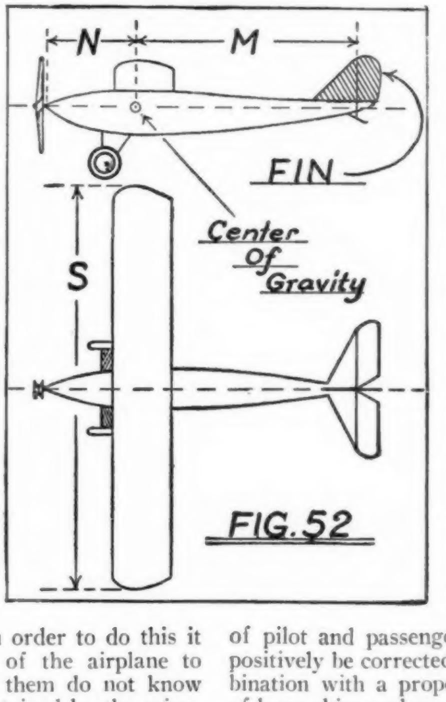


FIG. 52

Many of you have flown models that would "spin" easily (fall with a whirling motion like that of a maple seed when dropping) and without doubt you are familiar with this maneuver as executed by full-size ships. This takes place often contrary to the will of the pilot, with fatal results.

The sad part of all these fatal accidents is that they are unnecessary for it is perfectly possible to build airplanes that will not spin. In order to do this it is necessary only for the designer of the airplane to know certain facts which many of them do not know today, yet which can be readily ascertained by the scientific study of models *in free* flight. It is a statement which is not based on theory but on the facts ascertained from a series of practical tests made by the author, with many different types of flying model planes, over a period of twenty-three years.

The average present-day designer of large planes has obtained most of his data from the wind tunnel, which means of experiment will give accurate efficiency factors but very little and inaccurate data on stability. Most of the stability data obtained in the "tunnel" must be punctuated with guesses in order to be able to establish a theory regarding any particular phenomenon of stability.

Why is this so? The answer is fairly simple. In the wind tunnel the model is fixed to a spindle or arm of a balance through which any particular upsetting or disturbing tendency may be recorded. However, the simple or complicated *reactions* from a displacement cannot be registered, as no actual or normal displacement can take place originally because the model is fixed. Thus it is obvious that model planes can perform a real service as a medium for the scientific study of stability. Many have condemned it as a child's play, but it is merely child's play to a childish mind. The serious student can learn much if he is alert to the significance of the action of his ship when it is flying.

What principles can we incorporate in the design of our models to insure directional stability; to correct that spinning tendency, the arch fiend of all maneuvers caused by directional instability? Briefly, the factors influencing the situation are as follows:

1. The area of the vertical tail surfaces, to which we shall hereafter refer as "the fin."
2. The distance of the fin from the center of gravity. This we call the "fin moment arm." (This determines the leverage of the fin.) For practical purposes this distance will be measured from the center of the wing to the center of area of the fin.
3. The span of the wings.
4. The distribution of weights in the horizontal plane in relation to the center of gravity.

ONE may correctly say that the controlling factor in directional stability is the fin area. If there is sufficient fin area relative to other factors, stability is assured. If the fin is too small the plane will have a tendency to yaw (tail swing sideways, first one way, then the other) and "spin." When your model plane does either of these two things, simply increase the size of the fin sufficiently to correct the tendency. This is also the answer to correction of spinning in large ships. Usually the vertical tail surfaces on a large plane are cut down to the very minimum (and less) in order to gain added efficiency and a lighter structure. This procedure reduces the stability (directionally), increasing the spinning tendency and endangers the lives of pilot and passengers if there are any. Spinning can positively be corrected by using sufficient fin area in combination with a proper dihedral angle, both in the case of large ships and models. Without the dihedral the plane will usually dive in a spiral, but this is impossible when enough dihedral is provided.

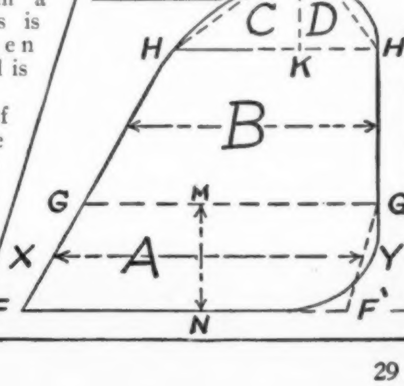
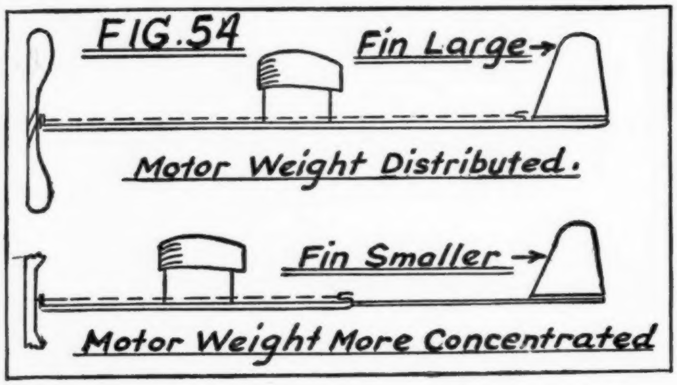


FIG. 53

The study of the effect of the fin on the spinning tendency of a plane was prompted by an interesting incident which occurred

while flying a fuselage model. The little ship was as close to proportions of a full-scale ship as it is possible to build it and yet have it fly. The ship had made several flights showing perfect balance when an admiring watcher accidentally broke off half of the fin.

Without pausing to mend it the model was flown again. On this occasion, the ship stalled slightly, from which maneuver it would normally recover its balance and continue on in flight. However, to the surprise of all present the plane fell off on its side and went into a tight spin. Thinking that possibly the action was merely peculiar to an unusual air condition, another flight was made. The same thing occurred again as on several successive trials. With a suspicion as to the cause of the trouble the broken-off piece of the fin was, cemented back in place, and thereupon another flight was made. There was no more spinning and the ship flew beautifully again.



From this incident it seemed probable that the reduction in fin area, due to a part of it breaking away, was the cause of the spinning, whereupon a long series of experiments were carried out, the results of which proved conclusively that the fin is the primary controlling factor. A discussion of the theory involved will be taken up later in this chapter.

If the fin area is the crux of the problem, how much area shall be given to the fin of any particular plane "in order to be sure of proper flight stability"?

A good general rule for the average model of regular proportion is:—*Make the area of the fin 12% (12/100) of the wing area.* Never make the fin area less than 10% of the wing area. Some models may fly correctly with less than this amount, but a model of average design cannot be depended upon to do so in all cases.

In order to be more certain of success it is advisable to classify models as fuselage models and stick models with and without a landing gear. 1. The fin area on scale fuselage models should be approximately 10% of the wing area. 2. The fin area on stick models with a landing gear should be from 11% to 12% of the wing area. 3. On models of the stick type without a landing gear the area of the fin should be about 14% of the wing area.

Models of the stick type usually require more fin area because the nose of the model is long, sticking out a considerable distance in front of the wing. Of course we have been speaking here of the tractor type of model only. In the case of biplanes the fin area should be about 20% less than in the case of a monoplane.

IT is all very well to know how much area the fin of your model should have, but many readers will not know just how to go about making a fin of a given area. Suppose we look into the matter of calculating the area of a fin. Begin by making a cardboard pattern of the fin, shaped to suit your purpose and about the size you think would give you the required area. Divide the cardboard pattern into sections as (A and B), Fig. No. 53, by drawing parallel lines (FF'), (GG'), (HH'), and into triangles (C) and (D). The area of each section can now be calculated and added together. The area of (FGG'F') is equal to (XY) [which is equal in length to ½ (FF'+GG')] times (M.N). The area of the triangles is equal to one-half the base times the altitude, or ½ (H K x K I), for triangle (C).

If you find that the cardboard pattern has not the correct amount of area, make (*Continued on page* 42)

Airplane Maneuver Contest

What Maneuver is Being Executed by the Plane on the Cover?

Do you wish to become a pilot? If you do, you will want to know how and why the plane is made to perform the maneuver that is pictured on the cover. Enter this contest and learn the basic principles of flight. $100.00 in prizes given away.

THIS is all you have to do:—Examine the cover picture carefully and determine what maneuver the plane is executing. This can be done by noting the position and attitude of the plane and the setting of the ailerons, rudder and elevators. When you think you can give the correct answer, write us, naming the maneuver and how it is performed. Also give your name and address, printed or typewritten.

Do this for each one of the six issues on which these covers appear.

Winners will be chosen on the basis of accuracy, neatness and the amount of detailed information given for the six maneuvers to be pictured.

The awards will be as follows:

Winner of 1st place—$25.00; 2nd place—$15.00; 3rd place—$10.00; 4th to 7th places inclusive—$5.00; 8th to 19th places inclusive—$2.50.

All answers to any particular picture must reach this office by the 20th of the current month.

The correct answer for any particular cover will appear in the following issue of UNIVERSAL MODEL AIRPLANE NEWS, with diagrams explaining the maneuver.

Send your answers to — Maneuver Contest, UNIVERSAL MODEL AIRPLANE NEWS, 125 West 45th Street, New York City.

Beside the prizes mentioned herein, the winner of each monthly contest will receive as a prize, the beautifully colored original painting of the cover picture.

An Automatic Stabilizer Regulator

A Device That Will Automatically Adjust the Stabilizer for a Good Glide at the End of a Flight

By C. L. Bristol

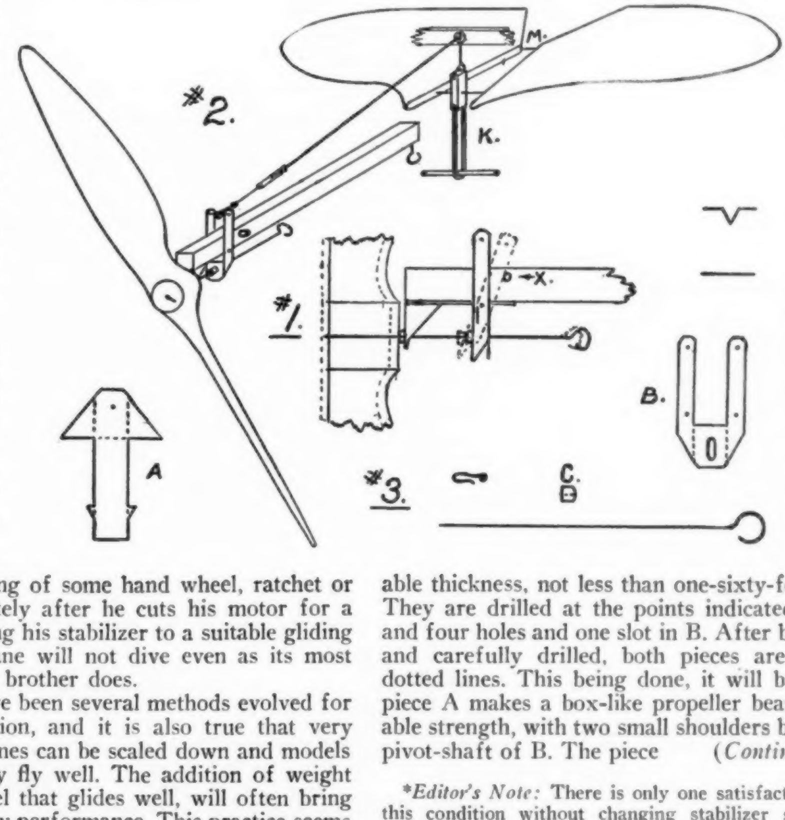
PRACTICALLY all builders of flying scale models are familiar with a certain difficulty that is often present, same being the tendency of a model that glides well to stall under power. And conversely, if the same model is adjusted through the medium of stabilizer setting for a normal rate of climb it is very apt to dive sharply and with tragic results when the motor runs down.

Most builders are too ready to blame themselves for such a failure, when in reality they are in pursuit of probably the most elusive quality of any airplane, a certain something called longitudinal stability. They have unknowingly built the very tendencies that they do not want into their ship, and they have done a good job because the full size plane would do the same thing under similar conditions.

We come now to the fact that the large plane itself does not fly and land with the same stabilizer setting. Those of us who have ridden in cabin planes or others of any size may have noted the pilot busily engaged in the working of some hand wheel, ratchet or lever device immediately after he cuts his motor for a landing. He is changing his stabilizer to a suitable gliding angle, so that the plane will not dive even as its most faithfully scaled little brother does.

Of course there have been several methods evolved for correcting this condition, and it is also true that very few types of large planes can be scaled down and models constructed that really fly well. The addition of weight to the nose of a model that glides well, will often bring about more satisfactory performance. This practice seems a shame, however, if the builder has schemed and figured to make every strut and brace count and to obtain the maximum strength in his model with the minimum of weight. A better way is the enlargement of tail surfaces and shifting of the wing to a point nearer the tail to compensate, a very commendable and satisfactory practice. However, it naturally throws a scale model out of scale.*

We present herewith a simple device by which the builder can obtain both the proper flying and gliding settings for his model at the proper time. It works on only one control thread and weighs practically nothing, besides being adjustable within itself. It operates on motor tension, as will be seen from the drawing. The angular view of the assembled set-up is half size, while the other drawings of parts and assembly are actual size. It will also be noticed that the arrangement may be applied to practically any model that a fellow would care to construct, although the drawing shows only the arrangement as it would appear in a fuselage model.

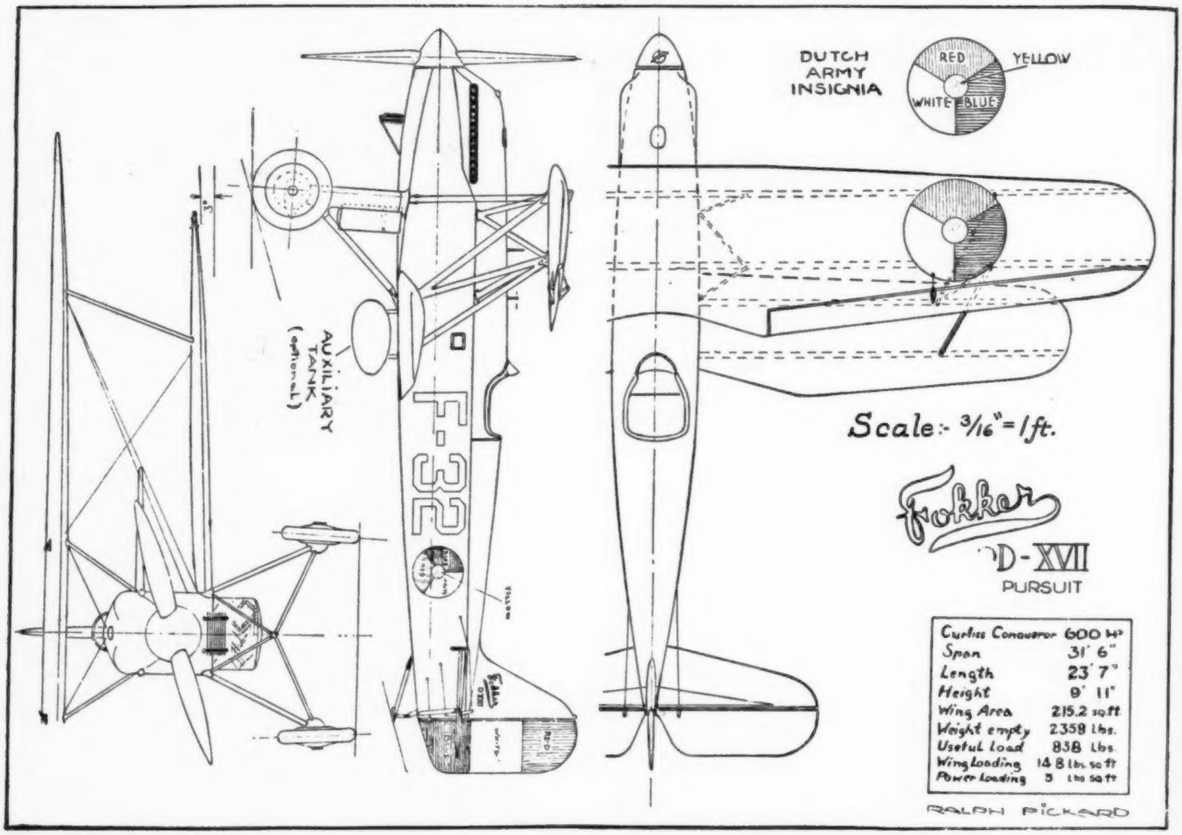


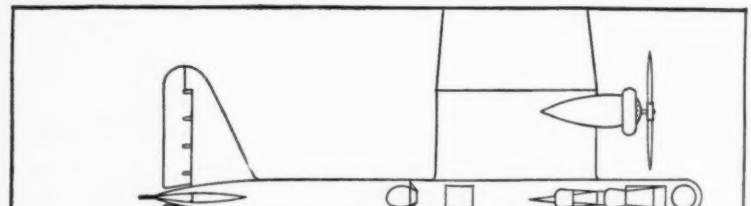
DRAWING 1 shows a side elevation of the parts in position, assuming that the motor is wound. Dotted lines in the same drawing indicate the position of the piece B, the propeller shaft and prop itself after the motor has run down. The rubber band K (in drawing 2) must be strong enough to pull the slack out of the motor through the forked lever B, as the small bushing C is soldered to the propeller shaft at its point of contact with B, when B is in an upright position. The stabilizer is hinged to the fuselage at the point M, the front spar being mounted in the balsa block that appears between the rubber return and the control thread. It is a good idea to make both of these spars out of bamboo, and provide slotted guides in the sides of the fuselage for the front spar. When the motor is wound, its increased tension overcomes the rubber K, pulls the prop back against its bearing, pulls B into an upright position, and incidentally raises the stabilizer to its flying angle.

Having traced out the action of our control we may proceed with the construction. Parts A and B are cut from sheet brass of suitable thickness, not less than one-sixty-fourth of an inch. They are drilled at the points indicated, one hole in A and four holes and one slot in B. After being cut to shape and carefully drilled, both pieces are bent along the dotted lines. This being done, it will be found that the piece A makes a box-like propeller bearing of considerable strength, with two small shoulders behind to hold the pivot-shaft of B. The piece (*Continued on page 39*)

**Editor's Note:* There is only one satisfactory way to correct this condition without changing stabilizer setting and this is to build your model so the center of gravity is *below* the line of thrust (propeller shaft).

If your model is already built and it dives at the end of flight, add sufficient weight to the wheels in order to lower the center of gravity the proper amount. Your model then will make a beautiful glide. (See Aerodynamic Design of the Model Plane in future issues for explanation.)





The Fokker D-XVII

THIS new Fokker is one deserving of attention. Built by the *Nederlandsche Vliegtugenfabriek*, Amsterdam, it incorporates many interesting features.

A welded steel fuselage and tail units, Messier oleo struts, an adjustable stabilizer, wheel brakes and a retractable radiator are a few of the features. The wings tapering, both in chord and thickness, are plywood-covered from leading edge to rear spar, and fabric from thence to trailing edge. Ailerons are also plywood covered.

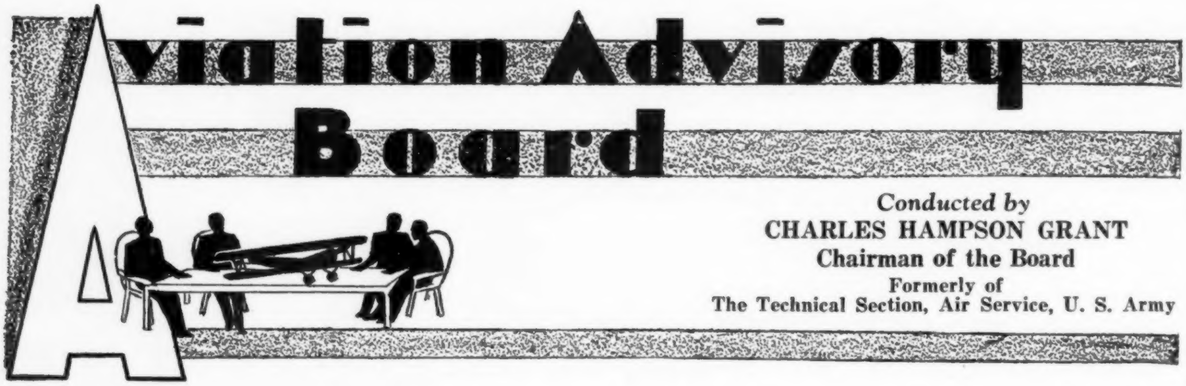
Powered with a 12-cylinder 640 h.p. Conqueror, she hits 190 m.p.h., at ground level; 158 at cruising speed; climbs to 22,960 in 20 minutes and lands at 65 m.p.h.

Armed with .5 cal., Vickers and a .3 cal., plus bomb racks, she can make a mean antagonist in any war.

The Boeing Bomber

HERE are authentic three-view drawings of the world's fastest bombing plane. It has a top speed of about 200 m.p.h. The retractable landing gear is partly responsible for this high performance. These plans are to a scale of 1/16 inch equals one foot.

Aviation Advisory Board



Conducted by
CHARLES HAMPSON GRANT
Chairman of the Board
Formerly of
The Technical Section, Air Service, U. S. Army

HERE are some of the questions for which you readers have been anxiously watching.

Our first question today is from Irving Klepper of 9 Wyndham Terrace, Short Hills, N. J.

Question: My scale model flies for about 50', then stalls. The propeller is still spinning when it lands. What is the cause of this?

Answer: This performance tells us two things. Under high speed the tail rises, holding the nose down. Under slow speed the tail drops. I would say the cause of the trouble is that the stabilizer has too much positive angle. The front edge should be dropped about 1/16 of an inch. The line of thrust may be pointing downward, which condition would cause the trouble. However, this is probably not the case. In any event, a change in stabilizer setting, as suggested, will cure the trouble.

Here are two unusual questions from Walter Brewer, R.F.D. No. 2, Framingham, Mass.

Question: How do air slots, located on the front edge of a wing, operate? Where should they be set and what cross-section should they have when used on a model?

Answer: Air slots on a wing are nothing more than a small auxiliary wing placed directly in front of the upper leading surface of the main airfoil. The under-surface of the small airfoil is approximately parallel with the adjacent surface of the large airfoil. If anything, the leading edge of the small airfoil is farther away from the large airfoil than is its trailing edge. This small auxiliary airfoil allows part of the air flowing below its leading edge to slip up through the slot back of the small airfoil. This air follows the upper surface of the large airfoil closely, causing the flow of air over the whole wing combination to be smooth. In this way, burbling or air boiling is reduced above the wing when it is flying at high angles of attack, 10 to 20 degrees. The cross-section of the small airfoil should be similar to the large airfoil wing section and placed so that the outline of the whole combination forms a normal airfoil section.

Question: On an autogiro, I have had to set the vanes well back near the tail in order to make it fly. Why is this so?

Answer: The lift on an autogiro is partly due to the vanes and partly due to the wing. The condition which you explain is evidently caused by the fact that the wing is set too far forward. Consequently, the vanes must be moved a considerable distance to the rear in order to compensate for this. Move the wings back and the vanes forward, adjusting them for proper flight. The rotor should be located approximately over the center of the wing, when properly adjusted.

TWO young men, Jonathan E. Thomas of 2042 Ohio Avenue, Connersville, Ind., and Clinton Berwood of 72 Vernon Street, Greenfield, Mass., ask questions relative to sweepback. They are as follows:

Question: Does sweepback add to the longitudinal stability?

Answer: Sweepback does not add to the longitudinal stability if the wing is placed on the machine so that the angle of incidence is constant for every chord of the wing, from root to tip. However, longitudinal stability will be increased considerably if the wing tips are given about 2 degrees less angle of incidence than the angle of incidence at the center of the wing. This has the effect of a negative tail.

Question: How does sweepback cause lateral stability?

Answer: I suggest you draw a diagram of a model with considerable sweepback. Now, supposing the plane tips to the left side. It will proceed then to slip towards the left. If you examine your diagram, drawing arrows showing the air approaching the sweptback wing from the left side of the machine, as would be the case under these conditions, you will see that the left wing presents more of its length to the approaching air than the right wing. The air slips off the right wing, running quite parallel to it. Thus, the left wing will lift more than the right, bringing the machine back to normal flight position.

Question: Is it possible to (*Continued on page* 41)

This Travel Air Speedwing, when powered with a 240 horse power Wright engine, has a top speed of 160 m.p.h., climbing 1100 feet per minute with full load. With a 300 h.p. engine, it makes 177 m.p.h. It is available with a 400 h.p. motor and is then guaranteed for 187 m.p.h.

Fighting Trademarks of the Air

(Continued from page 8)

readily distinguishable as those that are more familiar.

All aircraft of the Army are painted a deep olive-drab, for this color blends fairly well with the ground as a background. Hostile aircraft high above an Army formation would have difficulty in seeing them. Likewise all service planes of the Navy are finished with aluminum pigment which gives them the appearance of burnished silver. This color blends well with either the sea or the sky as a background and thus offers considerable protection. As a matter of fact it makes visibility too difficult in peacetime and to assist in locating a plane forced down at sea the upper wing surface is painted an orange yellow. It is probable, however, that a state of belligerency would see the use of aluminum paint on wing surfaces.

The national insignia carried on all airplanes belonging to the United States combatant forces is well known to all. It is a starred circle painted on each end of the top wing and on the under side of the lower wings. In detail the insignia consists of a red circle inside a white five-pointed star which in turn is placed inside a blue circumscribed circle.

While squadron insignia is useful for identification purposes, it generally is difficult to distinguish at a distance. For this reason each naval squadron is assigned a certain color which is painted on the entire tail surfaces of each aircraft belonging to that organization. This is by far the best distinguishing mark yet evolved. The varicolored tails can be seen at a great distance and quick recognition is assured.

Though a service squadron of aircraft generally consists of eighteen planes, the effective tactical unit in aerial warfare is the section composed of three planes. This unit is most effective and at the same time is not so large as to be unwieldy. Thus, when analyzed, it may be considered that the normal squadron consists of six sections.

For safety's sake it is essential that each section maintain its integrity. To assist in this each of these tactical units is assigned a color which is painted as a chevron on the upper wing surface. For instance, one section will bear green chevrons while another will carry yellow markers. To make it easier for the pilots of the wing planes, the section leader has a broad band of the section color encircling his fuselage. These identification marks serve to distinguish the planes to the personnel within the squadron.

ALTHOUGH the use of colored tail surfaces in the naval service has superseded the squadron insignia for identification purposes, nevertheless, the use of the squadron device will doubtless continue. Many of the Army Air Corps squadrons have continued in existence since the World War and, naturally, these units are proud of the traditions built up during actual conflict. Obviously, these organizations continue to use the insignia which proved so successful over the front lines of St. Mihiel and other desperately contested areas.

Naval aviation was reorganized after the war and none of the present squadrons date back to the conflict. However, practically all units have adopted various devices in which they have endeavored to portray the function of that particular organization. It may be that for some odd reason a squadron may have gained a certain reputation which is perpetuated by means of the insignia. No matter how trivial the origin of the device it soon becomes a thing of sentiment. Then, too, an insignia soon lends a name to a squadron and, thus the unit becomes a personality to the civilian populace of the country. While it might be somewhat difficult for the air-minded people of the country to discuss Fighting Plane Squadron Five they respond readily to the title "Red Rippers" which has been applied to this particular unit.

Everyone who has read of the National Air Races, which are an annual event at Cleveland, has heard of the Navy's Fighting Plane Squadron One, more popularly known as the High Hat Squadron. More recently this unit was brought to public attention in the moving picture, "The Hell Divers." The name is derived from the squadron insignia which is a high silk hat. Its origin lies in the fact that a former commanding officer of this unit possessed a mutilated black derby which he wore on all possible occasions. In fact, it eventually became a squadron symbol, for wherever the derby appeared one was sure to find a group of this unit's pilots. When the subject of adopting a squadron device arose everyone agreed that it should be a hat. It was found somewhat difficult to portray

(Continued on page 46)

Reflections of an Airplane Designer

(Continued from page 5)

we must define the general qualities of the plane.

The plane should, above all, be a good flying machine: stable fore and aft, so that if the nose goes down, the plane will recover of its own accord; responsive to all the controls; not likely to stall or spin readily and in case of a spin, able to come out readily when the controls are put in neutral; no tendency to turning over when landing with brakes applied; able to "taxi" well over the ground.

The structure of the plane must withstand all loads both in the air and on the ground, by a wide margin. Construction should be simple, maintenance easy. The motor and its accessories should be thoroughly accessible. Vision for pilot and student must be excellent, the cockpits well protected against the wind but easy to get into and easy to get out of in case of a parachute jump.

To make easy riding over a bad field, and for gentle landings, the landing gear must be carefully studied. When the plane touches the ground on landing, the whole plane moves down relative to the wheels, against the action of a rubber or hydraulic shock absorber. The greater the length of this downward travel, the less the shock.

Our reader will see what a great number of things the designer has to think of and will begin to agree that plane design is not an easy art! We will see now how a fine young engineer met this specification.

How a Brilliant Student Met This Specification

SOME time back, Mr. Guy Vaughan, president of the Wright Aeronautical Corporation, offered prizes to the students of the Daniel Guggenheim School of Aeronautics for the best design to meet the above specifications, with the splendid Wright Gipsy engine as the power plant.

The announcement of the prizes had a magical effect. Not that the senior students had previously slighted their work. No one with any imagination in his soul can carry through the design of an airplane without getting thoroughly interested in the job. But three cash prizes and a competition converted the work of the design class into a sporting event, and there is nothing the young American likes better than a sporting event. Towards the end of the competition the young men worked every spare minute of the day and sometimes far into the night.

When the three judges, well-known and experienced aviation men (Mr. Grover Loening, Mr. C. F. Emerson, Mr. C. K. Strunk), met to discuss the designs they expressed great approval of the work done and discovered many novel and original viewpoints in the drawings presented. They settled the method of marking in the following manner: out of a total of 100 points, 20 were allotted to general utility, safety and excellency of design; 10 to power plant, instrument and equipment installation; 10 to pilot and passenger accommodation; 20 to stress analysis and structural design; 10 to stability and control calculations; 10 to performance; 10 to drafting and detail design; and 10 to neatness and skill in presentation.

The marking was very close and the contest keen. Finally, Paul C. Spiess of Denver, Colorado, carried off the first prize of $100, and received shortly after graduation, a post with an airplane company headed by one of the judges. The "three-view drawings" shown on page 4 indicate to the experienced eye that the brilliant student had fully deserved the double reward.

The winner of the first prize submitted the following summarized figures with his many sheets of drawings and abstruse calculations:

Engine—Wright Gypsy, 4-cylinder, air-cooled, 90-100 H.P.

Wing Area	235 square feet
Airfoil Section	M-12
Aileron Area	26 square feet
Stabilizer	23 square feet
Elevator Area	17 square feet
Fin Area	17 square feet
Rudder Area	9.0 square feet
Gross Weight	1665 pounds
Weight Empty	1050 pounds
High Speed	103 miles per hour
Service Ceiling	13,700 feet
Rate of Climb at sea level	535 feet per minute
Stalling Speed	45 miles per hour

We can learn quite a good deal about airplane design by a study of the three-view drawings and this specification.

Monoplane versus Biplane and Side-by-Side versus Tandem

WHEREVER airplane designers foregather and the question of monoplane versus biplane is broached, the argument is apt to be endless and never settled. This is because, for certain purposes and under certain conditions, the monoplane is better; while for other purposes and under other conditions, the biplane works out more satisfactorily. Let us list the arguments pro and con.

The monoplane is cleaner and slightly more efficient, because there is no "interference" between wings to be feared and not so many struts and wires to impede progress through the air. The monoplane is a little cheaper to build; there is only one wing to build instead of two and, therefore, fewer parts, such as fittings, to make. Again, the monoplane looks better and the appearance of a ship has a great deal to do with its sales possibilities. Also, it is a trifle easier to get better vision with a monoplane because there is only one wing to get in the way.

On the other hand, the biplane will have a smaller span, since the wing area is now divided between two wings and neither wing need now be so long as the single wing of a monoplane. This is important from a housing point of view as hangar space is apt to be expensive. The structure of the biplane is apt to be a little lighter, because it evidently is easier to brace a biplane than a monoplane. Because the biplane has a narrower wing chord, it is a trifle easier to secure stability, that is, the ability of the airplane to recover automatically when it either noses down or noses up unduly.

Weighing everything, struggling hard to arrive at the best solution, Spiess decided on a monoplane, and did wisely, as the sequel showed. He had still another thorny decision to make. Should the pilot and student be seated side by side or in tandem—

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Lieut. Alan McLeod—Bomber

(*Continued from page* 19)

machines purposely established in this area to ward off marauders.

Even as he nosed down into the lower strata McLeod could see Fokkers and Aviatics speeding toward him to drive him off. But he pressed down undaunted. His reputation as an expert bomber had not been cheaply won and missile after missile dropped with unerring exactitude into the stirring human beehive below.

Then while on his way into the center of town, McLeod's speeding ship flew along the railroad right of way for a few moments and he dropped a projectile squarely on a troop train. What the damage was he did not pause to ascertain, but the sudden stop of the long train of cars and their ensuing envelopment in flames sufficed to tell him that his aim was still good enough.

On he flew, straight for town, with half a dozen or more Boches already on his tail, peppering away with their guns. But good old Hammond was back there in the gunner's seat protecting the rear, and McLeod pressed forward serenely. Directly ahead lay the railroad station with its important freight siding. Here, no doubt, the trains unloaded their deadly cargoes of munitions for transfer to the Front.

As he neared it, McLeod's fingers just itched to release the triggers that would drop the bombs. But long experience had taught him that a premature response meant only wasted effort. A few more seconds and then—click—two of the big fellows dropped from his plane; the ship's nose tilted up perceptibly as the lost weight gave added encouragement to the throbbing engine. McLeod glanced back below him. A mighty blast, instantly followed by another, flashed his latest success up from the scene of calamity and confusion below.

BUT any exultation that might have swelled through McLeod's breast at these triumphs was cruelly dispelled by more intimate surroundings. The Boche avengers, in speedier and more maneuverable planes, were upon him now and a murderous fire from a dozen machine guns concentrated upon the big bomber. The latter ship, even minus its weighty cargo, was still no match for the swift pursuit planes of the enemy.

But both McLeod and Hammond had no intention of giving up the ghost without a struggle. From his gunner's seat the latter kept up an incessant fire on all sides to hold the enemy at a respectable distance till McLeod could at least gain altitude enough to give his heavier craft a chance to maneuver better.

When he had gained an approximate altitude of 11,000 feet, the Germans had again organized their forces and drove in once more for the *coup-de-grace*. Eight Boches formed the party this time, each of them selecting a different point to attack from.

The resourceful McLeod called upon all the skill and courage at his command and maneuvered the unwieldy craft so expertly that he presented his faithful gunner with innumerable opportunities to reach vital spots on the cross-marked attackers themselves. Hammond responded to this clever battle for position that his loyal comrade was executing, by scoring three beautiful hits that sent as many ships from the fray mortally struck.

The quintet of Boches that remained drew off momentarily to regain their composure. Such counter fighting they had not expected from a mere bomber and it had disconcerted them. They circled warily like hungry wolves about a wounded stag, anxious for the taste of blood but, withal, holding too much respect for the courage and craftiness of their sorely pressed antagonist to risk their own life fluid to obtain it.

In this moment's respite Hammond shot a fleeting glimpse at the overworked McLeod. The pilot lay limp in his seat, whether mortally hurt or not, Hammond could not tell. The Boches, sensing something wrong, regained courage and swept in again. One marksman's aim was good enough to strike the gas tank and instantly flames crept up from the British bomber and licked their hungry way toward Hammond in the rear.

The hapless gunner felt that the end had come but determined to battle to the last as the fire encroached upon him. His face now was turned only toward the rear where his gun spat lead at the vulturelike ships hovering behind to await the doom of their prey. But the flames that Hammond was expecting to engulf him at any moment never touched him, though garments smouldered some from the sparks that flew back continuously.

Sparing another precious second to look ahead, Hammond was surprised to see his pilot, McLeod, now halfway out of the cockpit on the left-hand side, his foot on the wing of the plane to make it sideslip. The courageous McLeod, though cruelly hurt by more than half a dozen shots that had struck and all but killed him in the early part of the fray, had pulled himself together through sheer nerve. Realizing the fateful predicament of his gunner, he was sideslipping the fast-falling plane so that it bore to the left and thus sent the flames away from the tail, where Hammond was trapped.

Hammond recognized the brave and unselfish gesture in an instant and replied with the only resources at his command. He put renewed fury into the message that his gun had been issuing Bocheward. It was spoken in steel, words all soldiers know only too well, and the attackers kept at a respectful distance, far enough, at least, to prevent them from perpetrating further harm upon the two gallant Englishmen whose courage and resourcefulness had prevailed against such extreme odds.

But damage enough had been inflicted for Hammond, too, had reaped a fearful harvest of hurts in his own body and was almost unconscious when the ship came down awkwardly and abruptly right in No Man's Land. The sudden shock of landing sent the tail of the practically pilotless bomber snapping up into the air and Hammond was thrown out bodily. He fell heavily to the ground, completely stunned and out of his senses, with part of the still-burning wreck of the airplane partially covering him. McLeod, despite his terrible wounds, still had strength and life enough in his mutilated body to crawl over to his buddy and extricate him from the blazing wreckage of the smashed craft.

There midway between the German and

(*Continued on page* 42)

How You Can Build a World Record Glider

(Continued from page 25)

build our auxiliary wing tips, two of fig. (10). The root of these tips (the area from rib No. 1 to rib No. 2) being as the wing roots, covered with 1/32" balsa veneer. The root and end ribs are shown in fig. (11). Intermediate ribs (once glued) are sanded to correspond with these ribs.

To the end ribs attach a block of balsa 5/16". Sand to profile of rib, then streamline. Do not attach tips until general assembly.

(Note, Wing.) As balsa veneer cannot be purchased in 7" widths, splicing is necessary in order to obtain the proper width.

Stabilizer

In the stabilizer fig. (12), we again use the unconventional veneer-covered box construction which is characteristic of this glider. This time it is the area bounded by ribs a and b (top and bottom). Difficulty will be experienced as one must fit these pieces, but this may be overcome by the generous use of pins. To the ends of the stabilizer, glue balsa blocks 3/16" x 5/16" when dry. Sand to the shape shown in section AA in fig. (12). The number and shape of your stabilizer ribs are shown in fig. (13).

Rudder

Proceed as one-half of the stabilizer. In making it, take care to enclose with 1/32" balsa the area between the first and second ribs only, fig. (14).

Rear Plug

In order to fasten the rudder and stabilizer to the boom, we use a plug made of ⅞" square balsa. On this plug, fig. (15), we draw the outline of the largest stabilizer rib (both sides). When cut out, the stabilizer should fit snugly into this profile slot. Another profile slot is made on the upper side of the plug which is for the rudder connection. Having completed these operations round the plug to ⅞" diameter, then taper to the shape in fig. (16). This figure shows also the method of attaching the stabilizer and rudder to the rear plug. Notice the side view of same in figure (2).

Fuselage

For the fuselage make templates (full size) of the fuselage top, fig. (18) and the side, figs. (17) and (17a). Cut your fuselage to suit the templates, being careful that the diameter to fit the boom is ⅞", no more, no less, and that the vee-shaped slot, figs. (20) and (21), corresponds to the dihedral in the wing, so, when attached, the joint is snug. When completed, proceed to round the corners of your fuselage as illustrated in figs. (19), (18) and (20). You now can cut out the cover, figs. (17a) and (20). This may be done with a sharp razor blade. Finishing this step, proceed to hollow out a cavity to accommodate a generous amount of lead weight.

Your bamboo skid is made to shape through the use of an electric iron. Having bent it to shape, glue it to the bottom of the fuselage and add 1/8" x 3/16" bamboo braces, fig. (17a). Now bend out of No. 32 piano wire, the release hook, fig. (17a), and glue 1⅛" on skid. Wrap thread around it, and your fuselage, with skid, is complete.

Boom, Fig. (4)

Soak in water a sheet of balsa, 24¾" x 3" x 1/20", for one-half hour. This sheet, when wrapped over a straight piece of ⅞" diameter dowell and held in place with surgical gauze, will, when dry, form a cylindrical tube 24¾" long with a 3/16" overlap for a joint. Sand this joint until it is smooth, fig. (4). Finish entire tube with very fine sandpaper.

The wing, tail surfaces, fuselage and boom completed, we are now ready to cover the model.

Covering

We cover our model with No. 2 Superfine Cover so that the grain of the paper is parallel to the ribs. Nitrate dope (thinned) is used as an adhesive.

Doping

Three spray coats are used, first of which is water. Second is undiluted nitrate dope, and the last of which is a mixture of 80% nitrate dope and 20% of Titinine "Gloss" solution. The last coat, when applied, will give all the papered surfaces a beautiful lustre (essential for the minimum of skin friction). The Gloss solution accomplishes this.

All wood parts are given three coats of this solution, finishing each coat with very fine sandpaper.

General Assembly

Apply glue to the rear plug and add tail surfaces. Insert plug (with the tail surfaces glued on) into boom, the joint of which is on the underside. Wrap thread around this connection to make it firm. While waiting for the boom to set, fasten the wing to the fuselage. A generous amount of glue is needed for this connection. Sight and correct any discrepancies. Hold in place with tee pins until dry. Refer to figures (1), (2), (3), (17) and (21) for proper attachment. For tail surfaces, refer to figs. (2) and (16).

To make a complete unit, we now glue the boom (with tail surfaces) to the fuselage (with wing). We wrap the connection with thread. Sight now and then, to see that the boom has no negative or positive incidence and that it is in a straight line with the fuselage. The rudder should be parallel with the fuselage and skid.

Allowing the complete unit to dry overnight, we perform the final operation—that of adding the auxiliary wing tips. They are glued to the angles previously cut out in the wing tip rib, figs. (7), (2) and (3). Be sure the tips are parallel to the ribs and the rudder. They are held in place with pins. When dry, the model, now completed, will look like figure (22).

This model is not easy to construct, but the builder will be well satisfied with the completed model and amply repaid for his efforts when he flies it. The tow launch method of starting is used, with about 100 feet of string.

It will perform well in the wind, but best flights are usually made on hot, windless days.

The model weighs 5.1 ounces complete and the gliding angle is approximately 20 to 1. Ballast required is 54 BB shot varied according to the technique of construction.

Minimum resistance will be secured by filling corners with plastic wood; sanding after it is set.

An Automatic Stabilizer Regulator

(*Continued from page 31*)

B makes the movable fork upon which the entire arrangement depends for its action. In drawing 3, two small pieces of music wire are shown in their correct shape and size, opposite their respective places in B. The V-shaped piece slips through the top pair of holes to make a point of connection for the thread from the rear end, and the lower piece forms the hinged point on which the piece B rides. The small part C may be a short length of brass tubing, a wheel bushing, or even a brass washer, soldered in place on the propeller shaft later.

In assembling, care should be taken not to get the proverbial cart before the horse. First slip the two short wires in place on the piece B. Then slide B into position at A so that the straight wire rests on A at the small brass points which are bent downward to provide a solid shoulder. A drop of solder at the center of the wire holds B in place, with the slotted face of B toward the front. Next slip the propeller shaft through the slot in B, and slip the bushing C on between B and the bearing A. Then attach the propeller in the conventional manner, being sure to place a small bead or a watch jewel between prop and thrust bearing, and bending a square hook to hold the prop in place. You are now ready to solder the bushing C on the shaft, remembering to place it so that it holds B in a vertical position when the prop is snug against its bearing A. We come now to X, which is an all-important bamboo plug inserted in the motor stick and projecting out of each side behind B. The position of this stop should be far enough behind B to allow the backward movement of B and the thread, which in turn should allow the stabilizer to drop about two degrees or a little more in a model of notably tricky design.

A good model should fly with the stabilizer in neutral and the thread (of a stout linen variety) should be connected to B in its vertical position so as to hold the stabilizer at that point when the motor is wound. The installation of a small turnbuckle in this thread at the position shown in drawing 2 allows the builder to change the settings of the stabilizer. The difference between flying and landing positions will remain constant unless changed by moving the plug X.

It will be readily understood that the thread passes through a glass bead inlaid in a properly placed crosspiece in the top of the fuselage, and that the rubber K attaches to a similar crosspiece at the bottom. By providing a small wire hook on the front end of the thread at B as shown, the motor stick may be removed at will without throwing the tail end out of adjustment. For those who do not like to solder, a good grade of model cement can be used, with a combination of tightly wound thread and cement at the point C. This change will work out all right on lower powered motors. But for those who enjoy working with solder and metal, a number of combinations and embellishments are possible.

"Whats" and "What Nots" of Model Plane Building

(*Continued from page 18*)

of construction. The tail piece is a solid piece of balsa sanded to the proper shape. On the front end, a square or rectangular piece of balsa is glued, which fits into the fuselage to prevent the rubber from twisting the plug around. The rear rubber hook is run all the way through the plug and bent over for a quarter of an inch or so at the rear, and glued.

Where the model has the rudder at the extreme rear of the fuselage a different scheme must be used. Fig. 5, B, shows how this is done with a hollowed-out balsa fuselage. The piece is cut out after the fuselage is all finished otherwise, including the painting. Cutting is easily done with a razor blade and the angles of cutting shown must be carefully followed. The rubber, when wound, holds this piece firmly up in place, but it may be easily removed by pulling down and backward. The piece cut out has a plug glued on the forward end to keep it centered in the fuselage and helps to hold the tail hook which passes through it. It does not need to be square as in the other style, because the wedge shape of the cut prevents any turning.

For this same type of fuselage, a simple nose plug as shown in Fig. 6 is best. The front piece should be of hard balsa or thin spruce as it takes all the rubber pull. The rear piece, which goes into the fuselage nose, can be of any grade balsa.

The writer favors motor sticks which run the entire length of the fuselage. Scale models have limited duration anyway and it seems foolish to cut this down 25% or 35% by using a motor stick which runs only two-thirds or three-fourths the fuselage length.

THERE are several ways of fastening a motor stick in the rear. About the simplest is by means of a bent pin or wire bound to the rudder post, the forward projecting end of which goes in a hole drilled into the rear end of the motor stick.

This is often rather tricky to get in place, however, especially when the motor is wound to its limit. Another scheme is shown at Fig. 7. This consists of a piece of balsa sheet which fits inside the longerons as shown and has a square hole cut in the center. The end of the motor stick is slightly tapered to slide easily into this hole. The method is a good one to use as it is quite easy to slide the motor stick in place from the front.

The rear hook should be made of music wire, the size dependent on the amount of rubber to be used. It should be glued as near the rear end of the stick as possible, as this gives the longest span of rubber. Naturally, before gluing, it must be firmly bound in place with thread.

The stick itself may be made of balsa, preferably rather hard stock, or of spruce. The size or cross-section of the stick depends on the amount of rubber it is to carry. A spruce stick 1/8" x 1/4", and about 14" long, will stand six strands of 1/8" flat rubber easily. If in doubt, always make the motor stick oversize, as the breakage of a motor stick in the model is infinitely more disastrous than the breakage of the rubber, which is quite bad enough. If your motor stick has a tendency to bend, it may be corrected by gluing a so-called "can" on it in the middle. This is simply a loop of small music wire through which the rubber passes and is glued and bound to the top or sides of the stick. When the rubber tends to pull the stick into a bow shape, the "can" hits the tightly stretched rubber and prevents it. On the A frame or single stick endurance models at least one, and usually several, "cans" are used so that lighter sticks may safely be used.

At the front end of the motor stick we have the propeller hanger. These are made in a great variety of shapes from many different materials. Most of the shapes approximate an L, the long arm of which is bound to the front of the motor stick, with the short arm sticking upright. Through this short arm is drilled a hole for the propeller shaft. For smooth running this hole should be just a trifle larger than the shaft. The hole should be far enough above the stick so that the rubber will be well clear, especially when it is tightly knotted up. On a stick with five or six 1/8" flat strands, 1/4" is about right.

The propeller shaft should be made quite strong, about the same size as the tail hook. There is only one correct shape for a propeller shaft, and that is absolutely straight with an almost complete circle at the rear for the rubber. This is then inserted in the center hole of the propeller, bent over and glued.

It might be said here that the rubber can be put either above or below the motor stick, depending on the particular model, but if possible have the rubber above as this tends to lower the weight which is always desirable.

NOT much can be said about rubber, except to buy the *best* and *freshest* you can. Rubber lubricant is sold by most supply houses and is a great aid in securing long flights. It also preserves the rubber, but has the disadvantage of spattering and spotting paper-covered fuselages. This is another argument in favor of hollowed-out balsa fuselages.

For two-foot models, 1/8" flat rubber is the best size, while 1/16" square or flat should be used for the midgets.

There is not much to say as regards propeller making. Most everyone knows how to carve a workable propeller, but to carve a good one is a matter of experience, and no amount of words can help. The only advice which may help is to *always* cut the blank to exact dimensions first, drill the hole next, then carve. Always balance your propellers carefully afterwards by running a hat pin through the hole and setting on two parallel edges, such as razor blades. Sand off the heavy blade or side until good balance is obtained.

On a two-foot model allow at least 1/2" clearance between the propeller and the ground. The clearance on other sizes is in proportion.

There are almost as many ways of fastening the front end of the motor stick as there are various models. Some use a wire clip glued to the nose, into which the stick is pushed down after being shoved all the way back. In other models, part of the nose, such as the radiator, is fastened to the motor stick, this in turn being held to the fuselage by various means, ordinary snap fasteners being one. The best advice is, get a construction fitted to your needs.

Aviation Advisory Board

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obtain a correct taper on a wing by drawing lines parallel to the upper rib surface, each point on the new line being equidistant from this upper rib surface, in order to produce a taper wing?

Answer: No. This will not give similar airfoils. The best method to follow is shown in the August, 1932, issue of UNIVERSAL MODEL AIRPLANE NEWS, Page No. 14.

Jonathan E. Thomas also wants us to explain the reason for the rotation of the autogiro vanes.

Answer: This is quite difficult without a diagram. However, we will try to make it clear. As an airfoil passes through the air, the resultant force acting on the airfoil will be upward and slightly backward from the perpendicular to the air stream or relative wind. Now, as we know, the chord of the airfoil of the autogiro is approximately parallel to the plane of rotation of the autogiro, possibly set at an angle of 2 degrees positive. The spindle around which the vanes rotate is set so that the plane of rotation of the vanes is at a considerable positive angle to the line of flight. Now, as these vanes rotate with the relative wind striking the vanes on the advancing side at about 8 degrees, the resultant force on the vanes, we will say, is upward and acting slightly to the rear of the perpendicular to the relative wind, as described above. However, this resultant force acts *forward* of the perpendicular to the plane of rotation of the vanes, because the relative wind acts at an angle of 8 degrees to the plane of rotation. It can be readily seen that when the resultant force acts forward of the perpendicular to the plane of rotation, the vanes will be dragged or driven forward against the air which flows against them. This will probably be hard to understand without a diagram. I suggest that you draw a diagram including the forces which I have mentioned in this explanation and see if you cannot determine my explanation.

Sawing Balsa Wood

Here we have a question regarding the sawing of balsa wood, from Mr. H. Deutsch of New York City.

Question: What is the best type of circular saw blade for cutting balsa?

Answer: You fellows with workshops will probably like to know the answer to this one. The best saw to use is a type called the "variety" or "novelty" saw, the teeth of which have no "set." The sides of the saw and the teeth are perfectly flat and the teeth do not flare outward as is usually the case in ordinary saws. Thus, when you saw balsa with this type of saw, the sawed surfaces will be smooth and even, with no scores or saw marks on it. The teeth of this type of saw may be described in this manner: There is a set of large teeth about an inch wide at the base and upon each one of these large teeth there are several smaller teeth.

Henry Toll of Amherst, Mass., would like to know the name of the German machine which was shown on the April cover. This machine is a Halberstadt fighter, used on the Front in 1916. The engine used in this machine is a 180 h.p. Mercedes. The wing spread is approximately 35 feet.

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Lieut. Alan McLeod—Bomber

(Continued from page 37)

Allied trenches, McLeod, unmindful of his own devastating tortures, threw the inert form of his cherished gunner over one shoulder and staggered toward the friendly Allied trenches that meant ultimate safety. Even then the battle was not yet won for German snipers, bent upon avenging the deaths of their own fliers—the concluding acts of the air drama had been clearly witnessed by the men in the trenches—started a vindicative rifle fire after the weak and staggering McLeod and his precious human burden.

Twice he fell flat as Boche bullets pierced his anguished frame but the great spirit that had carried him thus far would not be denied. Each added ache acted only as a greater incentive to live and he arose with a mighty effort. Perhaps the progress now was a bit slower but the indomitable spirit urged him on as strongly. Another step and he was atop the friendly trenches, where helping arms, outstretched, waited to help. McLeod literally fell into the welcome ditch with the almost lifeless Hammond on top of him.

Both men were immediately removed with tender care to a hospital, where experienced hands and loving attention of doctors and Sisters of Mercy nursed the tiny sparks of life back to normal again.

For his part in the gallant but gruesome exploit, Lt. Hammond was justly awarded the Military Cross, a fitting companion medal to the great Victoria Cross that was bestowed upon McLeod for his unrivalled display of heroism and unselfishness.

The Aerodynamic Design of the Model Plane

(Continued from page 30)

it larger or smaller to give the required amount. This can be done by estimating and then recalculating the area. If there is a chance of inaccuracy, make the fin too large rather than too small, for too much area will do no harm, while too little will cause poor flights.

Shape of Fin

WHEN shaping your fin, be sure to make the height of it not less than 80% of the length from front to rear, see Fig. No. 53. The greater the height of the fin compared to the length, the more efficient it will be. If the fin is too low, it will be blanketed by the wings and stabilizer when the ship is in stalling attitudes and will lose most of its correcting effectiveness.

Fin Moment Arm

The fin moment arm may be defined as the distance from the center of gravity of the machine (usually a distance of 1/3 of wing chord back of the leading edge of the wing) to the center of area of the fin. This moment arm determines the amount of leverage the fin exerts and is therefore a measure of its effectiveness, M, Fig. No. 52. Of course the fin's effectiveness may be increased by making it of larger area as previously explained. From this we see that the farther the fin is from the center of gravity, the *smaller* it may be and yet give the same stabilizing effect. Thus it may be stated as a law that the shorter the moment arm the larger the fin must be, or *vice versa*, the longer the moment arm, the smaller the fin may be and yet obtain satisfactory results. It is *advisable in ordinary cases* to make the fin moment arm equal approximately to one-half the span of the wing, or if the model is a biplane or multiplane, it should be equal to one-half the *average* span of the wings.

We have said above that the fin should be 10% of the wing area for the average fuselage scale flying model. This is true when the fin moment arm is equal to (½S), one-half the span. But suppose you wish to make the fin moment arm larger or smaller than this, then what would be the correct size of the fin? Here is a good rule to follow:

The product of the moment arm and the area of the fin in one case should be equal to the product of these two quantities when either of them is changed. For example, if (a_1) equals the first amount of fin area, (a_2) the second amount, (M_1) the first moment arm [used with (a)] and (M_2) the second moment arm, then

$$a_1 M_1 = a_2 M_2 \text{ or } a_2 = \frac{a_1 M_1}{M_2}$$

Thus we can find what the fin area should be if the moment arm is of any other value than (½S), where (S) equals the average wing span.

If the moment arm of a particular model is 12 inches and the fin area (10) sq. in., and it is decided to change the moment arm to (14) inches, then by the formula the fin area should be (8.57) square inches, for

$$a_2 = \frac{10 \times 12}{14} = 8.57$$

This is an approximate yet fairly accurate method for determining the correct fin area.

However there are other factors that enter the problem. The *location* of the weights of the parts that form the structure of the model, *relative* to the position of the center of gravity, has considerable influence on the model's longitudinal stability.

The ideal situation is where the various centers of weights of the parts forming the construction of the model are very close to the center of gravity of the whole machine. In such instances the fin may be made smaller than is usually the case or the moment arm may be made shorter and yet retain directional stability. In large ships this ideal situation may be attained to a greater extent than in model planes. It is the general procedure in large plane design to group all of the parts of the plane that have great weight close to the center of gravity. Some of these parts are the motor, the gas tank, the pilot and instruments. In a model this is not possible to as great an extent. In fact this is the secret of the failure of flying scale models (so-called) to really fly well.

In the large plane the weight of the motor is concentrated near the center of gravity, while in the model the motor is usually a series of rubber bands the weight of which is *distributed* throughout the entire length of the fuselage. This gives more momentum to the swing of the tail and therefore it requires a greater dampening or resisting effort. As this effort is produced by the fin, it is obvious that for any

given length of moment arm, the fin *must* be *larger* to retard this greater swinging tendency.

In designing flying scale models, the designers do not take this fact into account but instead scale down all the measurements of the large plane and build their model accordingly. Thus the fin (all tail surfaces) is too small to act properly when a rubber motor is installed. If a motor with concentrated weight is used, the fin might be sufficiently large, but usually the large plane has none too much fin area and it is much safer to make the fin of the model larger in proportion to the large ship, especially as the model must fly itself without the correcting hand of the pilot on the controls.

As it is desirable, make the rubber motor of a model fairly long in order to have it absorb as many winds as possible, the body or fuselage frame is usually quite long. It extends out in front of the wing further than is the case with large ships. Because of this fact the frame weights are usually located still further from the center of gravity of the whole plane, which condition requires even larger fin area. This is particularly so because the propeller is located a considerable distance from the (C. of G.). The propeller generates more or less torque which has a tendency to swing the tail to the left when a right-hand propeller is used, as well as to turn the machine over on its left side. This disturbing or swinging effect of the torque becomes more pronounced the further out the propeller is located, in front of the wings..

MANY of you may have experienced difficulty with models on which the propeller is way out in front of the wings at the end of a long frame or fuselage. The cure is to enlarge the fin or shorten the nose of the model.

Remember, the longer the nose the larger the fin must be and *vice versa.* You will have noticed that the use of a fin area of 14% of the wing area has been advised in stick models without a landing gear. The long nose usually existing in models of this type is the reason for this advice. Fig. No. 54.

A type of construction used lately which has helped to correct this difficulty is the short motor stick with tail boom. This combination brings the center of gravity forward, thus allowing a shorter nose and also helping to concentrate the weight of the rubber motor nearer to the center of gravity. Both of these conditions tend to give greater directional stability and thus the fin area required is less than in the old type of construction. A long moment arm may also be assured when a tail boom is used, which is an advantage.

It is difficult for the model designer who desires accuracy to calculate the size of the fin when several variable factors are involved, so the following formula is given by means of which you can calculate the *correct amount of fin area for any model.* This takes into account all the important variable factors mentioned.

In the formula, a_v = Area of the fin required, A = the total wing area. M = the horizontal distance from the center of the wing to the center of the fin. S = the average wing span. N = the distance from the center of the wings to the nose of the fuselage (propeller bearing). See Fig. No. 52

$$a_v = 0.09\ (A/M)\ (3 + S/8 + N)$$

Next month's installment will bring some little-known information about spiral stability and begin the discussion of the most puzzling problem of all, *Longitudinal Stability. Until then, Happy Landings.*

Aviation Advisory Board

(*Continued from page* 41)

Question: Does the use of a rubber lubricant increase the power of a rubber motor or merely increase the life of the motor?

Answer: Rubber lubricant does not increase the power of the rubber motor. In fact, the power is decreased when it is used. On the other hand, a greater number of turns may be put on a lubricated rubber motor. Lubricant does not increase the life of the motor. A fairly good rubber lubricant is glycerine.

Air Ways—Here and There

(*Continued from page* 23)

I suppose that we might infer that this is a mailplane. However, Roy Marks of 69 South Irvine Avenue, Sharon, Pa., has not told us whether or not this is the case. He does say that it flies as well as it looks when the scale model propeller is removed and the flying model propeller is attached in its place.

Picture No. 19 shows a very neat endurance model, built by John B. Hastings of 311 North 8th Street, St. Joseph, Mo. This machine has a 30-inch wingspan and weighs .0225 ounce. It is certainly a neat-looking job. Close examination will show an especially good job of covering. We will be interested in hearing what duration Hastings gets from this machine.

Picture No. 20 is one of a Fokker triplane, built by Herbert Weiss of 452 Hampshire Street, Lawrence, Mass. It is a neat-looking job. Weiss tells us that it is complete, even to the imitation motors and leather seats. This is the 25th of a group of models which he has built, which models represent all nations. The largest plane, he tells us, is a Curtiss Condor, with a span of 12 inches. The smallest is a Gee-Bee with a 2⅝-inch wing-span. Weiss does not go in for size, evidently, but unquestionably the practice of building these small models will make him adept in the art.

CLUB NEWS

THE four Boeing Bombers shown in Picture No. 21 are the winning models in a contest recently held by the Model Aircraft Engineers of Milwaukee. Starting with the nearest ship and proceeding back, the models were built by Herbert Markweise, first place; Gordon Zimmerman, second place winner; George Wischer, third place, and Orville Goeden, fourth place. While all the models are capable of flight, they were judged solely on accuracy and workmanship. More than a dozen ships were entered and there were many different types of construction employed. This contest was one of a series of monthly contests held by the club for models built from plans in the current issue of UNIVERSAL MODEL AIRPLANE

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• *See Classified Directory Page* 48 •

Reflections of an Airplane Designer

(*Continued from page 36*)

that is, one man behind the other? Here again is an argument which is never definitely settled. If a pilot sits side by side with the student, it is evidently much easier to instruct. There is no need, then, for a system of signals between the pilot and student, or for an interphone. For a sportsman pilot, the side-by-side arrangement is much more sociable. If a man does own a plane and wants to give a friend a joy ride, he wants his friend to sit by his side, companionably.

These are good arguments for the side-by-side arrangement. But there is a good deal to be said for the tandem arrangement also. In the side-by-side, the vision may be excellent on one side, but it may be quite difficult to see on the other side. The tandem fuselage can be made narrower than the side-by-side. And a narrower fuselage means less weight and less head or air resistance. Therefore, all other things being equal, the side-by-side arrangement makes for greater speed. Still another advantage of the tandem is this: when a student is receiving instruction he may be close to the pilot, but still he is in another cockpit. Therefore, when he makes his "solo," or first solitary flight, he does not miss the companionship of his instructor so much.

The young designer finally selected the side-by-side arrangement. If we imagine ourselves sitting in the cockpit, we can realize that his design also gave good vision above, below and ahead. The seating arrangement was pronounced well-nigh perfect by the judges.

Wing Area and Speed

THE wing area of Spiess's design was 235 square feet. This is very generous and much more than is generally employed by designers of a craft of this size and weight. But then the design with this generous amount of wing area would really be capable of realizing the stall speed of only 45 miles per hour. True that with this large wing area and wide fuselage the contestant failed to attain the 110 miles per hour which the specification called for. However, the judges thought the 103 miles per hour claimed, to be a conservative estimate and declared that the speed would be adequate for all practical purposes.

Some Other Good Points

There were many other good points about the design. A good forward position of the center of gravity makes for longitudinal stability. But while the C.G. was well forward along the wing, it was well behind the point where the wheels touch the ground. When a machine is landing and the brakes are strongly applied, its momentum tends to carry it along and the airplane may turn over onto its nose. But if the center of gravity, where all the weight of the machine may be considered as concentrated, is well behind the wheel base, then the momentum due to gravity counteracts the nosing-over tendency. The Spiess design met this requirement admirably.

The rudder was placed high above the fuselage. With the machine flying at a large angle to the wing with the nose well up, the rudder tends to be "blanketed" by the fuselage. With the high rudder, this blanketing need not be feared. So the high rudder got the contestant a point or two from the judges. The control surfaces and the stabilizer were generously proportioned. And this, in the judges' opinion, made both for stability and control. While a monoplane was employed, it was not a cantilever monoplane, with all the bracing carried inside. Some little external bracing in the form of struts and wires allowed the designer to use a simple, untapered wing that is of the same chord width all along. This made for lightness and simplicity and the air resistance of the bracing was small. Finally, by careful design, the young engineer kept the gross or overall weight down to a low figure, namely 1665 pounds. Nothing can ruin a design so quickly as overweight. With overweight, the landing speed goes up, the top speed goes down and the whole design loses in value. Here, also, a crucial test was met successfully.

Materials and Construction

Space will not permit us even to deal briefly with the internal construction of the plane. To settle on the internal construction, laborious calculations have to be made (stress analysis, as it is called) and weeks and weeks have to be spent in the process of figuring the strength and size of spars, struts, wires, etc. We can only say that the fuselage was to be of welded steel tubing, which is easy to fabricate and in a crash landing will bend but not break. The wing spars were to be made of metal but fabric covered. To cover wings with fabric instead of metal seems rather an untidy thing to do, and metal-covered wings make for permanency. But the metal covering is apt to be heavy and it is much easier for inspection or repair to pull off the old fabric and cover with new, than to destroy the metal covering and rebuild.

Only an Outline

THE above is only the briefest outline of what a designer must do to turn out a really fine ship. Still we hope it will give our readers something to ponder over and encourage them to further study on their own. In our next article we shall take up a much more complicated type, the passenger transport airplane, which is constantly growing in importance as the number of air travelers increases.

The Monocoupe Takes the Air

(Continued from page 11)

diameter. A ⅛" square stick may be rounded off for this purpose. Cut them about ¾" long and glue carefully in place. Sight around them before the glue sets and, if necessary, move some of them until they are evenly spaced. When dry, cut a piece of scrap balsa to fit closely into the hole in the nose piece D. Using this as a center support, scribe around the cylinders with a compass to get the exact length for them. Cut carefully at the marks with a razor blade and sand the tops slightly round, so the motor ring will fit on smoothly. Then around the top of each cylinder, wrap four turns of braided silk fishline. Do not use cotton or braided string, as the fuzz does not take paint well. Apply glue before each wrapping, holding the ends with pins till it dries. Then cut close with a razor blade.

The ring is made from a strip of balsa ½" x 6" and ⅛" thick. The grain must run crosswise so the piece may be bent to shape easily. You will probably need to use several pieces cut from wood two or three inches wide and glued end to end to make the 6" length. Sand one edge of the piece to the proper cross section for the ring, then wet it thoroughly and roll around a 1 ¾" can or bottle, holding in place with a small rubber band. When dry, glue it around the motor and finish sanding to shape.

The exhaust pipes and manifold are made of 5/32" diameter reed. If it is found difficult to bend, soak in water a minute or so. Of course it cannot be glued in place until dry. Also do not glue it on until the fuselage is papered.

Wings

THE wings have three spars and a trailing edge. The leading edges are ⅛" x 3/16" balsa. They are first cut to the shape shown and sanded smooth. The tubing which slides over the wing pins are next bound in place. Before binding, make a shallow slot for the tube so that the end of spar I, the leading edge, will line up with F of the center section. The rear spar J is ⅛" square balsa and also has the tubing bound to it.

The ribs are of the same size and curve as those of the center section but the spar slots are placed slightly differently, so they are called curve No. 2. Ten are made from 1/16" balsa. Curve No. 3 is the tip rib of which two are used. The small nose ribs help keep the leading edge paper in shape and add practically no extra weight.

The wings should be assembled directly over the drawings and, for this reason, a full-size view of each wing is given. Assemble the main ribs and spars first and add the tips and nose ribs afterwards.

When the wings have been assembled and are dry, remove them from the board and sand off all rough edges with fine paper. Next, glue on the aluminum tubing for the strut ends. Each piece of tubing extends from bottom to top of the rib so they should be individually cut to fit.

The struts are made of bamboo in order to get them very thin for less wind resistance and yet retain sufficient strength. They are 5/32" wide and between 1/32" and 1/64" thick. The edges should, of course, be rounded off smoothly. The struts must be cut to fit as each model will be slightly different. They are, of course, adjustable, that is, each wing may be adjusted for dihedral or incidence by setting the wires correctly. The struts are assembled on a board by gluing the apex together and adding the triangular piece of balsa. The lower wire is also glued on at this time. When dry, the struts may be removed and the joint wrapped with thread for strength and rubbed with a little glue over all. At this time, the remaining wires may be bound and glued in place.

If the tubing for the fuselage end of the struts has not yet been put in place, do this now. This tubing slopes downward so that the end of the wire may come out of the bottom of the fuselage to be bent over.

The wire to use for the strut ends may be any *soft* wire, such as copper or brass, and about No. 20 B and S gauge. You will only need about a foot of it. Music wire cannot be used as it is so brittle and hard.

Try the wings on with the struts in place. Adjust them so that when the struts are up tightly against wings and fuselage, the wings will have a dihedral of about ¼" on each tip as in the large ship. Then the wires can be pulled out somewhat to give an inch or so of dihedral which is necessary for proper stability in flight.

Covering

THE first part to be covered is the front half of the fuselage. When this is done, install all windows, windshield, and exhaust pipes. Then finish the fuselage and tail surfaces. Cover the wings last, then spray all paper lightly with water, preferably from a small paint sprayer or ordinary atomizer. Incidentally, some perfumes come in sprayer bottles, which, when cleaned out, are excellent for this purpose, as they are built to give a very fine even spray without any large drops, which is just what we want.

When the paper is all dry, it will be very tight and smooth and the finishing work can be done. If a beautiful job is desired, the paper can be coated with some of the new enamel dopes which give a fine glossy surface. Of course, this adds weight, but not a great deal.

All wood parts such as pants, propeller, cowl ring, etc., are coated with some filler, such as white paste, to fill the pores. This is sanded with very fine paper to get a good painting surface.

The color scheme is a matter of personal preference, the model here pictured being finished in black and yellow, with aluminum propeller and exhaust pipe. This makes a beautiful model, especially if details such as license numbers, etc., are carefully painted on.

In covering the model, use paper of a color as near as possible to that you wish to finish with. For example, the writer's model had a fuselage covered with dark blue, while the wings were white. Then only one coat of rather thin dope was needed to give the desired finishing color.

Your model is now finished and ready for testing. You must first glide it to get the proper balance. The tail surfaces may be adjusted slightly or the wings can be warped by means of the strut wires. Naturally you must make your preliminary tests in as soft a place as possible, prefer-

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Fighting Trademarks of the Air

(*Continued from page* 35)

a derby, so a high hat was used. Queerly enough, the device has completely removed all trace or reference to the original derby which formed the basis for the insignia.

At one time the primary mission of Fighting Plane Squadron Six was to act as a light bombing unit. That is, its function was to drop small fragmentation bombs, after which the planes were to carry out the duties of a fighting squadron. Because of the small size of the bombs it is obvious that extreme accuracy must prevail if hits are to be recorded on the objective. To obtain the desired accuracy it frequently is necessary for the planes to fly very close to the target; in other words, they are delivered personally by the pilot. One of the members of this squadron in an idle moment sketched a "Krazy Kat" with a lighted bomb in his hands running along as though to give it to someone. The humorous expression on the cat's face combined with the necessity for a rapid disposition of the explosive makes it an accurate shield, indeed.

WHEN first rebuilt as an airplane carrier, the *U. S. S. Langley* was facetiously called "The Covered Wagon" because of her peculiar shape and striking resemblance to a prairie schooner. Her slow speed and lumbering gait as she rolled and pitched in response to the waves contributed towards making this expression exceedingly apt. Accordingly, her planes carry a sketch of the famous old Pullman of the pioneers.

If one were to see an aircraft bearing, as an insignia, the portrait of a pointer dog, the inference would be quite clear. Obviously, since a pointer is used for hunting it would indicate a search, and therefore, Scouting Squadron Two has adopted such a device for its squadron insignia.

At one time the planes of Scouting Squadron One were equipped with an unusual type of amphibian gear in order that they might operate off a carrier as a landplane and still retain the safety factor of the seaplane. The landing gear was of the single pontoon type with the wheels installed on the solitary float. The weight of the installation reduced to some extent the performance of the plane and made it appear unwieldy. Thus, the insignia adopted shows a bird with small wings, consequently of doubtful flying ability. Its feet or landing gear are shown by pontoons with wheels attached thus indicating the amphibious nature of the squadron. The glasses demonstrate the necessity for good eyesight and that the primary mission of the squadron is that of scouting.

A wild Canadian goose invariably recalls to a person's mind a fowl that can fly tirelessly at high rates of speed for hundreds of miles. Moreover, nature has provided this bird with an unusual degree of homing instinct so that it is enabled to fly accurately in a straight line to a predetermined destination. These same qualities are possessed by large multi-engined patrol planes whose mission is to search large areas hundreds of miles at sea. Expert navigation and long endurance are essential to this type of flying and aptly enough Patrol Squadron Nine has adopted for its insignia a drawing of a wild Canadian goose in full flight.

The dragons of old were generally reputed to possess the ability to spout fire and smoke from their nostrils. If combined with the power of flying, they would have been fearsome creatures, indeed, and certainly something to avoid. They were considered to be impregnable to attack and their offensive powers were terrific. It is quite reasonable, therefore, that Torpedo Plane Squadron Two should adopt for its insignia a drawing of such a dragon riding towards its enemy, mounted on the back of a deadly torpedo.

The primary mission of the Naval Air Station at Pensacola is to give flight training to naval personnel. As might be expected its device is drawn around one of the requirements found difficult by the embryo flyer. The insignia shows a gosling fitted out with helmet and goggles landing in the water. Obviously, the marine scene illustrates the Navy, while the smug expression upon the gosling shows its extreme delight at arriving back upon the surface of the water while still whole. The splashing water indicates an unskilled landing while the attitude of the feet illustrates clearly the helplessness of the average student until he has gained considerable experience.

The Monocoupe Takes the Air

(*Continued from page* 45)

ably in tall grass. When you get it adjusted so it glides smoothly and without any tendency to stall, power can be applied and a real flight attempted. Of course, for the best distance, a winder must be used on the motor.

The finished weight of the model naturally determines the flight duration. The model pictured in this article weighs 1¼ oz. complete, but this model is rather heavily built and has a good deal of dope and paint on it, which increases the natural weight. If you wish to have the utmost duration from your model, build it of selected light-weight balsa and cover with colored paper, using no dope whatever. By this means you should be able to build a ship weighing around ¾ oz. which would fly on very little rubber and thus have greatly increased duration.

Another means toward getting the greatest possible duration is to remove the wing struts when trying for a record. This takes off only a slight amount of weight, but the lessened wind resistance is considerable.

The Monocoupe is naturally a very trim ship, and a well-made model, decorated properly with numbers, etc., makes a beautiful little airplane indeed.

Air Ways—Here and There

(*Continued from page* 43)

NEWS, the official magazine of the club. After six contests, a member having won the highest number of points will receive a silver trophy.

The Model Aircraft Engineers of Milwaukee is an organization of high school and college students, formed in 1930. It is the leading exponent of model aviation in the city of Milwaukee. At present the members are studying astronautics through a series of lectures by Kenneth A. Cook. Prospective members are invited to contact K. A. Cook at the Y. M. C. A.

There seems to be a thriving model airplane club in Danvers, Mass. Irving Day of 2 Dodge Court, Danvers, Mass., has sent us Pictures No. 22 and No. 23. Picture No. 22 shows the members of the club with some of their ships. They represent many different types from which some excellent flights have been obtained. Picture No. 23 shows an S.E.5 in flight. This machine was built by one of the club members. Unquestionably these young men have exceptional ability along this line. Other pictures which they have submitted show the excellence of their work, but they have not been clear enough for publication. We welcome information concerning the activities of these young men at any time.

J. M. Garrett of 15 Queenstown Road, Onehunga, Auckland, S.E.5, New Zealand, has sent us some information concerning activities on the other side of the world. Mr. Garrett is secretary of the Auckland Model Aero Club. He has sent us several films taken of models of this club in flight. These, however, we have been unable to publish as they have not arrived in time for proper prints to be made. (For the information of contributors:—Do not send films of pictures. In order to have your pictures published, it will be necessary that we have a clear print from which to make our plates.) Mr. Garrett tells us that D. Drage has built a scale model of an S.E.5, which has flown 60 seconds. In building this model from plans which appeared in UNIVERSAL MODEL AIRPLANE NEWS, he has used longeron strips 1/32 of an inch square instead of 1/16 of an inch square. This has cut down the weight considerably. Another record-breaker of this club is W. B. Mackley, whose fuselage model has flown for 5 feet, 53 inches.

MR. EARL STAHL of 810 Sutter Street, Johnstown, Pa., sends us some information which, he feels, may be of interest to our readers. He says: "We have a new plan of ranking in the Ferndale High School Aero Club. The plan is similar to that of the U. S. Navy Air Corps. Instead of President, we have Skipper, Vice-President, Executive Officer, etc. Our club advisor, George Townsend, has the rank of Commanding Officer. We also have two pilots and a parachute jumper to advise us. They are Alfred K. Young, transport pilot, and Lloyd Stahl, private pilot and 'chute' jumper. A. Merle Seese is also a 'chute' jumper." This club seems to be quite progressive insomuch as it uses a moving picture projector to run off films which are interesting and educational. We will look forward with interest to receiving more news from this enterprising club.

FROM New Haven comes interesting news of the New Haven Junior Aero Club, of which Eric Mood is president; Walter Frisbie, vice-president; Arnold Hansell, secretary; Paul Carulo, treasurer; Jack Steed, program chairman. Eric Mood says the club is making great progress and if anyone wishes to join, they may do so by writing to the club headquarters at the New Haven Municipal Airport. In order to stimulate activity, plans for a contest have been made, which will be held on April 21 and 22. The events will be "solid scale," "flying scale," "endurance," "R.O.G. Commercial," "Freak," and "Speed." Prizes will be given to the winners of the various events.

The Connecticut Model Aeroplane Association, an amateur body, sponsored the initial meet of the season at the mammoth State Armory, Hartford, on December 3, and it proved a distinct success. This auspicious opening was a triangular competition between the New Britain Junior Achievement Aero Club, the Hartford Model Aero Club and the 43rd Aero Club of Meriden. New Britain won the meet with thirteen points, Hartford was second with ten, and Meriden third with five points.

There were three events on the program and Herbert Owen of New Britain took first place in two—the duration and the R.O.G. George Gumbs of Hartford won the speed contest. Sixteen boys entered the competition, which ran from 10 a. m. until 4 p. m., with but a short interruption for luncheon.

Complete information may be secured from Mr. Schade, Junior Achievement director, City Hall, New Britain.

(*Continued on page* 48)

• *See Classified Directory Page 48* •

Air Ways—Here and There

(Continued from page 47)

CORRESPONDENTS WANTED

FROM John R. Baumer of 2448 94th Street, Jackson Heights, L. I., New York, comes the following: "Here is a new hobby—negative swapping. I have pictures of a great many ships; pictures you would be proud to own, but the negatives are idle and no longer needed. At least not by me, but how about you? If you have any negatives lying around that are not working, write to me. I would like to swap one of mine for a DO-X; 116 Brownie negative preferred."

Here we have a letter from Jimmy King of 528 North Dearborn Street, Indianapolis, Indiana. "I have a very good plan for starting a model airplane club. It creates interest. All boys who are interested, send self-addressed envelopes to me for information."

Frank Yellen of 130-21 95th Avenue, Richmond Hill, New York, writes us that he would like to correspond with boys all over the world, so some of you readers had better get busy with this young man.

Here we have news all the way from Australia. Stan Baker of 8 Alexander Street, Concord, Sydney, New South Wales, Australia, leader of the Concord District Branch of the Model Flying Club of Australia, marvels at some of our long flights. He is intensely interested in having model enthusiasts of this country correspond with him. He says: "I will guarantee to answer all letters personally. We would also be grateful to any model airplane readers who could let us have old planes of the following planes, as they are not obtainable anywhere in Australia. In return, we will send anything we may be able to get for them over here, such as aboriginal curios or other Australian products. These are the plans we want:

Fokker Tri-plane	Sopwith Triplane
Curtiss Condor	Ford Tri-motor
Heath Parasol	New Boeing Bomber
Curtiss Hell Diver	Spad
Fokker Tri-motor	Fokker D-7 and D-8
Travelair Biplane	Stinson Model U

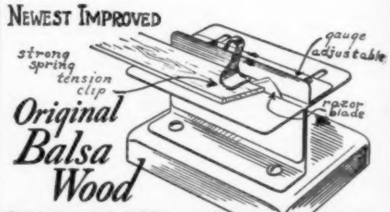
Keystone Pirate Bomber

Cannot some of our readers help out our Australian friends?

The Plane of the Future?

(Continued from page 9)

NOW, if you fellows are interested enough in this model write in and tell your good friend, the editor, who will tell Mr. David Dixon Grant, the author of this article, and the builder of the models described in it. Maybe I can get some more information on this plane, and even publish some drawings so you can build it. But now, just one word to the wise: don't waste any time and good materials trying to build a model of this ship before the plans come out, because you will not be successful. Unless the wings are placed in exactly the correct relationship to each other, it will not work. This relationship cannot be found by looking at pictures, so control your zest and wait a while. Meanwhile drop a line to C. H. Grant (No relation, thank you) and ask for the plans if you want them.



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Everything to Complete a Real Model Glider, with a Purchase of $1 or More.

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Note
All Balsa shown here in 18" lengths can also be had in 36" lengths, if requested.

Check Your Needs NOW!

Balsa Wood
This balsa is clear, straight grained stock. It is strong, light, and free from defects. If hard or soft wood is desired, specify when ordering.

18" Lengths

1/16 x 1/16	26 for .05
1/16 x 1/8	24 for .05
1/16 x 1/4	24 for .07
1/8 x 1/8	24 for .05
1/8 x 3/16	24 for .09
1/8 x 1/4	24 for .12
3/16 x 3/16	10 for .06
3/16 x 1/4	10 for .07
1/4 x 1/4	10 for .08
1/4 x 3/8	6 for .08
1/4 x 1/2	6 for .09
3/8 x 3/8	6 for .09
3/8 x 1/2	6 for .10
1/2 x 1/2	4 for .10
1 x 1	2 for .16

40" Lengths

1/8 x 3/8	.03
1/8 x 1/2	.03
3/16 x 3/8	.03
3/16 x 1/2	.04

Sheets—18" Lengths

1/32 x 2	4 for .07
1/16 x 2	4 for .06
1/8 x 2	4 for .09
3/16 x 2	2 for .08
1/4 x 2	2 for .09

Plank Balsa

1 x 3 x 36	.25
1 x 6 x 36	.38
2 x 3 x 36	.42
2 x 6 x 36	.75
2 x 5 x 40	.75

Propeller Blocks

½ x ¾ x 5	8 for .06
½ x ¾ x 6	8 for .07
⅝ x 1 x 7	8 for .09
⅝ x 1 x 8	4 for .06
¾ x 1⅛ x 8	4 for .08
¾ x 1⅛ x 10	4 for .09

⅝ x 1½ x 11	2 for .07
⅞ x 1½ x 11	2 for .08
⅝ x 1¼ x 12	2 for .07
⅝ x 1½ x 12	2 for .09
⅞ x 1½ x 14	2 for .16

Dowels
Straight grained, true size birch dowels — highest quality grade.

1/8 x 18" long	7 for .05
3/16 x 36" long	6 for .05
1/4 x 36" long	4 for .05

For a limited time 12" lengths.....12 for .05

Bamboo
Genuine, straight grained, no-knot TONKIN Bamboo. Strong and light. Splits easily.

	Doz.
1/16 x 1/4 x 15"	.07
1/32 x 1/4 x 8"	.04
1/16 x 1/16 x 9"	.03

Japanese Tissue
A fine tissue for covering flying scale models. Strong, light, and takes dope well.
20 x 24.........3 for .05

Veri-Fine Tissue
One of the lightest tissues known. Excellent for endurance models, because of its extremely light weight.
20 x 15.........04

Colored Tissue
Just the thing for the new bright colored ships that are so popular nowadays. Red, Orange, Brown, Blue
20 x 24.........2 for .05

Wood Veneer Paper
Very useful in scale and flying-scale models. Strong, yet light enough to fly.
20 x 30.........13

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1. Orders under 25c not accepted—due to our very low prices.
2. Add 15c for packing and postage on orders up to $1.50; on orders for $1.51 and over add 10% for packing and postage charges.
3. Add 10c extra to above charges on Balsa plank orders less than $1.50 West of the Mississippi and Canada.
4. Postage stamps, Canadian or Foreign Coin not accepted as payment.
5. Remit by check, postal or express money order. Make payment to MADISON MODEL AIRPLANES, INC., 134 Livingston St., Brooklyn, N. Y.
6. Add 5c for insurance against breakage in transit.

Canadian Charges—Add 25c for packing and postage on orders up to $1.50. On orders of $1.50 and over add 15% packing and postage. Postage stamps, Canadian or foreign coin not accepted as payment.

Dealers and Clubs Write for Special Price List

Celluloid Wheels
Experience has proven these wheels best for flying scale models.

	Pair
3/4" wheels	.05
1" wheels	.07
1 3/8" wheels	.09
1 7/8" wheels	.13

Bushings
for wheels.......4 for .02

Music Wire
Strong, springy wire sold in this new, convenient manner.
1 ft. lengths—straight .014, .020, .028, .034
6 feet for .02

Dummy Motors
The very thing for adding that realistic touch to scale and flying scale models. Extremely light. Nine cylinders.

1 1/2" diam.	.16
3" diam.	.28

Rubber Thread
Careful testing has proven this rubber to be the highest in energy content per unit of weight. This means more turns and less breakage.

.045 sq.	50 ft. for .12
3/32 flat	50 ft. for .13
1/8 flat	50 ft. for .13
3/16 flat	50 ft. for .16

Complete PLANS for

Winnie Mae or Bellanca	Twin Pusher - - - 10c
Pacemaker 15 inch	3 R.O.G. Stick Models 10c
Full Size each - - 15c	Travel Air Mystery Ship
Outdoor Cabin Tractor 10c	24 Inch Full Size - - 40c

ALUMINUM ITEMS

Drag Rings
Used on the real ships for cutting down wind resistance. Makes a beautiful addition to any radial motored model.

1 1/2" diam.	.15
2" diam.	.17
2 1/2" diam.	.22
3" diam.	.25

N.A.C.A. Cowlings
No dummy motor needed when this cowling is used. Has a hole for thrust bearing in the nose.

1 1/2" diam.	.15
2" diam.	.17
2 1/4" diam.	.23
3" diam.	.26

Aluminum Tubing

.010 wall thickness	ft.
1/8 O.D.	.05
3/16 O.D.	.09
1/4 O.D.	.11

Aluminum Leaf
Real sheet aluminum, yet almost as light as paper. Makes a beautiful covering job.
.0003 thick
3 1/2" wide...5 ft. for .05

Sheet Aluminum

12" wide	ft.
.003	.12
.005	.12
.010	.16

Washers
For indoor, outdoor, and flying scale models.
Large size, 1/4 O.D.
Dozen, .01; Gross, .10
Small size, 1/8 O.D.
Dozen, .01; Gross, .10

Clear Cement
The fastest drying, lightest and strongest cement on the market. Try some now. You'll be amazed at its marvelous properties.

1 oz. tubes	.06
2 oz. tubes	.08
4 oz. cans	.20
1 pt. cans	.60
1 gal.	4.50

Clear Dope
Just suited for the model user's requirements.

2 oz. cans	.07
4 oz. cans	.13
1 pt. cans	.35
1 gal.	2.50

Acetone
For thinning out heavier liquids.

2 oz. cans	.07
4 oz. cans	.13
1 pt. cans	.35
1 gal.	2.50

Colored Dope
Highest quality pigmented dope. Do not confuse with inferior grades. Leaves a smooth, even color upon drying.
Blue, Red, Yellow, Orange, Silver, Black, Olive Drab

2 oz. cans	.09
4 oz. cans	.17
1 pt. cans	.60

Thrust Bearings
Light, strong bearings. Hole is truly centered.
Large size .035 hole
Each, .01½; Dozen, .15
Small size .025 hole
Each, .01½; Dozen, .15

Insignias
U.S. Army and Navy type. Improves the appearance of models by 100%. Each sheet contains 4 stars in circles for the wings, and red, white and blue stripes for both sides of the rudder.

	sheet
1" diam.	.02
1 1/2" diam.	.03
2" diam.	.04
2 1/2" diam.	.05

Outdoor Twin Pusher

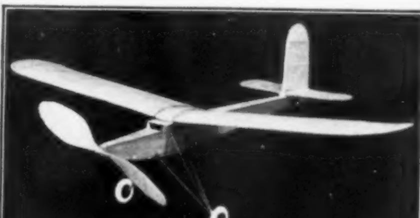
A twin pusher that has actually flown 12 minutes not once—but several times. This plane has several features which cannot be found elsewhere. It has a 40-inch "A" frame that is a marvel for lightness and strength, a 36-inch, high cambered, tapered wing, and two 12-inch, high pitch props powered by 68 feet of ⅛ flat rubber. The kit contains complete plans and instructions, stamped ribs, and all other materials needed for the construction of the model. Price **$1.50** Add 10c for Postage

3-in-1 Kit Three R.O.G. Stick Models **$1.00**

TWO-IN-ONE KIT

Contains the around-the-world "Winnie Mae" and the "Trans-atlantic Bellanca." Both 15" wing spans. Kit contains full size plans, bulkheads, large tube of cement and all other materials needed to complete these two wonderful models. Get yours now.

$1.25 POSTPAID



Outdoor Cabin Tractor

One of the snappiest flying models in its class, proper engineering and all balsa construction does it. This plane has a double surfaced, high lift wing, 30-inch span, all balsa fuselage, extra strong landing gear to withstand the shocks of outdoor flying, and a large, wide-bladed propeller to keep it up for long endurance flights. The Kit contains complete plans and instructions, stamped ribs, large tube cement, 1 oz. bottle clear dope, pair celluloid wheels, and all materials needed to complete the model. Price **$1.50** Add 10c for Postage

MADISON MODEL AIRPLANES, Inc., 134 Livingston St., Brooklyn, N. Y.

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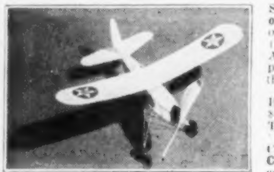
ONLY $1.95 Prepaid or at Dealer's

←SPECIAL! 4 PLANES→

ONLY $1.95 Prepaid or at Dealer's

SAVE 30c! Order, Build, Fly These GREAT FLYERS!



Dipper: 12½" x 9½"

50c Prepaid

SAVE 30c AND get 4 BIG 12" balsa Gliders **without extra cost** by ordering this "Flying 4" group of Comet planes:—Dipper (50c), Phantom Fury (50c), Z-i-p-p (50c) and Army Pursuit (75c)—ALL FOUR (Regular $2.25 price) for **only** $1.95 prepaid! This Bargain Offer is to **introduce you** to the FAMOUS COMET LINE OF FLYING PLANES the kits that are making thousands happy! But you MUST ACT PROMPTLY BEFORE $1.95 offer is WITHDRAWN! IMPORTANT! Please note that this is not a "4-in-1" Kit—but 4 **Separately** Boxed and Complete Kits! What a **buy!** Order **on Coupon below.** Cash orders **prepaid.** Order convenient **C.O.D.** way—send no money, just pay postman for kits, C.O.D. fee, postage **on delivery!** 100% Satisfaction GUARANTEED.

A GREAT IDEA!

Show this ad to your parents. Tell them **Comet** model building **trains** your **mind** in aviation **engineering**, teaches you to use your hands, is great fun—and is VERY ECONOMICAL! Ask Dad to get one—thousands of Dads are building 'em! Hurry—get started!

The coupon below entitles you to Special $1.95 price AT YOUR DEALERS or by mail. Use it!

4 GLIDERS GIVEN!

Buy one kit—get 1 Glider! Buy 4 kits—we give you 4 Gliders! Etc. Hurry, act promptly!

BIG! 13" x 10½"

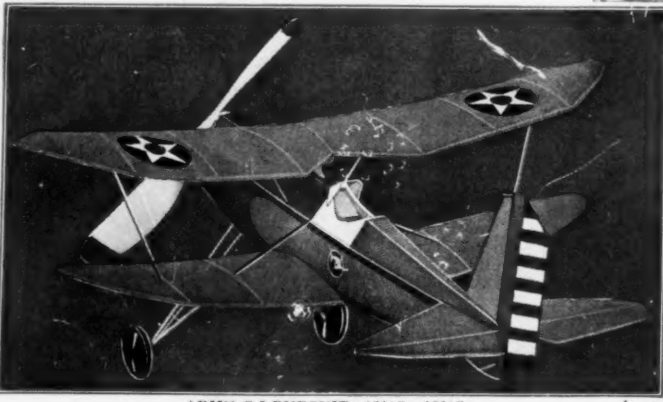
"What a Flyer!"

50¢ Prepaid or at DEALER'S

Note The Pants!

"My DIPPER FLEW 900 Feet!"

"Was packed the best and best material I ever saw. I easily built it and it flew over 900 feet its first flight!" **(Bob Latas,** Colo.) This amazing Dipper weighs 1/3 oz., rises off ground, **flies like an eagle—easily** built! Thousands built, flown successfully. Colored snow-white, red, blue. Everything needed to build, fly; packed in purple, sturdy box including Glider, 50c prepaid! Save money—order Dipper in "Flying 4" group at $1.95. (S. Hageboeck of Iowa received over **100** flights with **his** Dipper—and ordered 2 more!) You get **yours,** now!



ARMY C-I-PURSUIT: 15½" x 12¼"

Here's Comet's AMAZING NEW FLYER: *The PHANTOM FURY!*

Boy, O BOY! Everyone's **crazy** about our new, speedy Rider of The Night Skies! An **astounding** value for 50c with its nifty **wheel-pants—stream-lined** landing gear! Weighs ½ oz. And here's a SECRET! The new Comet **Phantom Fury** is **easier** to build than the world-famous 50c Dipper—and FLIES LIKE A SILENT, AVENGING FURY! **Is this the secret ARMY PLANE we hear about but never see?** The Phantom Fury will be the FLYING **sensation of your neighborhood, so** ACT QUICKLY! We've made up a SMALL SUPPLY, rush your order for the $1.95 special "Flying 4" group which **includes** this great kit! All COMET kits give you MORE for your money — are EASY to build — and are as **COMPLETE** as the Phantom kit! For example, **here's what you get in the Phantom kit:** (no cutting needed) Colored Jap tissue, yellow, blue, black—special balsa "prop" block—printed rib sheet—pants **punched out**—bamboo—balsa noseblock and headrest—sandpaper—tube cement — banana liquid — all wire parts —**FULL** SIZE (3-View) plans — illustrated, easy instructions! Packed neatly in **colored box with Glider, 50c prepaid.**

NEW ARMY PLANE! "C-I-Pursuit Made RECORD of 1300 FEET!!"

says **Clyde Kowalka** (Ohio), "**and the easiest** ship I ever constructed — plans so easy to follow. Made a record competitive flight of 1300 feet!" C-I-Pursuit looks like a real Army biplane. Here's what Robert Menees (Ill.) says: "Pursuit took off, flew as if it were a **real** plane!" Takes off, scuds thru skies, makes perfect 3-point landing! America's most popular 75c plane! For a genuine thrill get your C-I-PursuitNOW!

75c Prepaid or At DEALER'S

(COMPLETE Kit in big Box), at 75c prepaid, or in the MONEY SAVING "Flying 4" Group! Glider is included!

15" x 11"

Clyde Kowalka, with his Pursuit ship. A real Comet booster. "Happy Landings," Clyde!

Z-I-P-P FLYER REDUCED in Price! Was 75c Zipp NOW 50c!

"Never Saw A Kit So COMPLETE As The Zipp! The Drawing's SO CLEAR—and DOES SHE FLY!"
JACK PFEILER (So. Dakota).

Get it, fly it like Jack Pfeiler of So. Dakota did! This BIG beauty OUTFLIES the Dipper! Be FIRST to thrill your friends with the cloud-soaring Zipp. Hurry! COMPLETE kit with FULL SIZE 3-view plans (ALL Comet-Craft have 'em!) comes with Glider, only 50c prepaid—was 75c! Zipp comes in "Flying 4" group at special $1.95 price. Get **yours!**

Alan Cummings with his 4 Comet planes. **Great work, Alan!**

"COMET Planes Are The EASIEST Built, Best Looking, BEST FLYING PLANES I EVER SAW! Your SERVICE Is Very Good and P-R-O-M-P-T!"

Then Alan Cummings continues: "Your C-I-Pursuit and HEATH Baby Bullet (Bullet not shown here, order it at $1 prepaid) were dandies! They look swell—just like real planes—and FLY well too!" BOY AND MEN BUILDERS! Why experiment? Buy, build and FLY Comet planes—they cost so little—give you such HEAPING FULL value—and FLY LIKE REAL! Order COMET-CRAFT from now on to get 100% Satisfaction. Do what THOUSANDS upon THOUSANDS do—join the Comet Crowd! Send Coupon—**order!**

DEALERS! Write for GUARANTEED SALES Plan on letter-head. Thousands make easy, extra PROFIT. You can, too! Write!

5-COLOR CATALOG 5c Amazing. Shows planes in ALL colors. Supplies listed. Limited supply. Hurry! Send 5c for mailing cost. WORTH 10c.

SEND NO MONEY -- Just Mail COUPON!

100% Satisfaction or Money Back!

WE TRUST YOU! Order convenient C.O.D. way—send no money—just mark, mail coupon—pay for kits, C.O.D. fee, postage—ON DELIVERY! We prepay **cash** orders. Remit cash by M.O.! If you send check, add 15c extra. All orders west of Mississippi, 10c more. (CANADIANS: **No** C.O.D., stamps nor coins. Send INTERNATIONAL Money Order adding 20% to cost of kits.) HURRY! Order the "Flying 4" at SPECIAL BARGAIN PRICE of $1.95, **before we withdraw** the Special Low Price! Order from COMET dealer if possible, just present THIS COUPON to get $1.95 price on "Flying 4" group!

COMET Model Airplane & Supply Co., 3114 Harrison, Dept. M 23, Chicago, U.S.A. **Dealers!** This coupon entitles bearer to "Flying 4" group at $1.95. Send coupon for 30c credit

C.O.D. ☐ Send C.O.D. kits checked. I'll pay postman for kits, C.O.D. fee, postage, ON DELIVERY. Comet **guarantees** 100% satisfaction!

CASH ☐ I enclose $ ______ for kits checked. Send **prepaid.** Comet **guarantees** 100% satisfaction!

SEND ME NEW GLIDER WITH EACH KIT ORDERED!

"Flying 4", Special at $1.95 ( ) OR: Send kits checked: ( ) Dipper, ( ) Phantom, ( ) Pursuit, ( ) Zipp, ( ) Red Racer, ( ) CATALOG, 5c.

PRINT NAME ____________ Street ____________

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QUICK! Get This NEW F-A-S-T RED RACER!

"FLIES Extraordinarily Well!"

That's what one Red Racer enthusiast writes us. Here's 1933's SENSATION! Speedy! Beautiful. EASY to build with famous COMET plans, directions!

HOW THIS RED-HOT Speed Demon FLIES! Get yours **without** delay—now. Your Red Racer is WAITING for you inside brilliantly colored, sturdy box, including Glider! Only $1 prepaid. Build it, RACE IT! (NOTE! This kit NOT included in "Flying 4" Group!)

Worth at least $1.50

$1 Prepaid or at DEALER'S